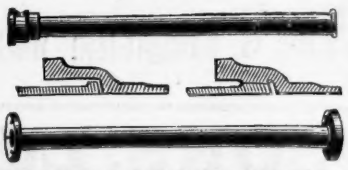
THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXIII. No. 1879.] LONDON, MAY 16, 1899. [51ST YEAR. PRICE 6d.

GAS AND WATER PIPES

1¼ to 12 IN. BORE.



THOMAS ALLAN & SONS,

Bonlea Foundry,

SOUTH STOCKTON-ON-TEES.

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ESTABLISHED 1848.

ALSO MANUFACTURERS OF

SANITARY & RAIN-WATER PIPES, HOT WATER PIPES STABLE FITTINGS, RANGES, STOVES, And GENERAL CASTINGS.

Telegrams: "BONLEA, STOCKTON-ON-TEES."

ALUMINIUM SMOKE-TOPS

FOR

INCANDESCENT LIGHTS,

Manufactured by

OBERFELT & CO.,

BERLIN, 62, CHARLOTTENSTRASSE.

HEATHCOTE GAS COAL.

Rich in Illuminating Power and Yield of Gas.

Above the Average in Weight and Quality of Coke.

Maintains a High Standard in Residuals.

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PARKER & LESTER,

Manufacturers & Contractors.

GAS-LEAK INDICATOR.

For Particulars and Price apply to

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Prices and Analysis of all the Scotch Cannels on Application.

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HOPE CHEMICAL WORKS, HACKNEY WICK, LONDON, N.E.,

And at Pharos Works, Hackney Wick.

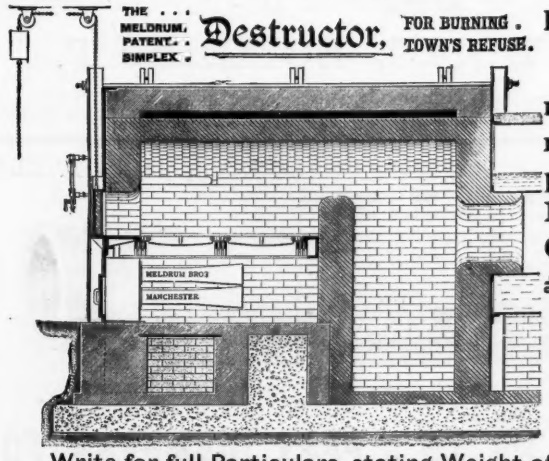
NAPHTHA AND GASOLINE DISTILLERS AND PETROLEUM IMPORTERS,

Specially distil Carburine Spirit, specific gravity ·680, or of any other grade suitable for Enriching Gas; also Gas Oil best adapted for injecting into the Retorts, as in the Herring Process.

Importers of Petroleum for Carburetting Water Gas, or for Manufacturing Oil Gas. Distillers of Pentane, Petroleum Ether, and Naphtha for clearing the pipes of Naphthaline, &c.

Samples and Prices may be had on application.

THE Utilization of Towns' Refuse for some practical purpose has been successfully solved; and there is, therefore, no reason why every township should not have its own Electric Light Installation, and obtain all the power from its Dust-Bins.



At Hereford City the Sewage Farm is now worked entirely with power from refuse, 1¼ million gallons being pumped per day, besides Sludge-Presses, Sludge-Pumps, and Lime-Mixers—the saving in Cost of Coal (not now used) being about £300 per annum.

AN INSTALLATION ON SIMILAR LINES NOW ON ORDER FOR HUNSTANTON WATER-WORKS.

Write for full Particulars, stating Weight of Refuse per annum, and for what purpose you would wish to use the Power, when we shall be glad to submit a suitable Scheme.

MELDRUM BROS., ATLANTIC WORKS, **MANCHESTER.**

DANIEL HOWARD,

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GASHOLDER & BOILER WORKS,

WEST BROMWICH, NEAR BIRMINGHAM

(ESTABLISHED 1765).

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WROUGHT AND CAST IRON TANKS FOR DITTO,

PURIFIERS, CONDENSERS, SCRUBBERS, HYDRAULIC MAINS, and all kinds of GAS APPARATUS,

Wrought-Iron Roofs, Bridges, Girders, &c.,

Steam, Hot Water, and Range Boilers, Tanks, Cisterns, Boats, and all kinds of Wrought-Iron Work.

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With Improved Centre-Valves, to work either One, Two, Three, or Four Purifiers at one time.

SLIDE VALVES.

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SEAL-REGULATING VALVES.

GASHOLDER VALVES.

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SELF-ACTING BYE-PASS VALVES.

COMPENSATING VALVES.

UNSOLICITED TESTIMONIAL.

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Hand-Power LIFTS, suitable for weights up to 10 Tons.

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HIGHEST AWARDS—LONDON, PARIS, COLOGNE, VIENNA, MELBOURNE, AND OTHERS.

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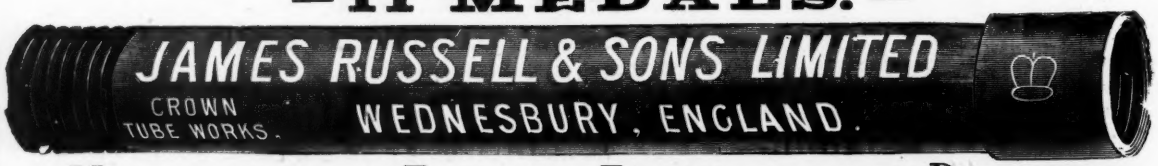

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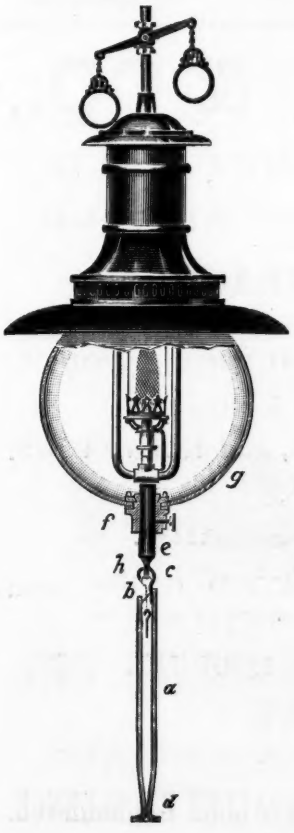

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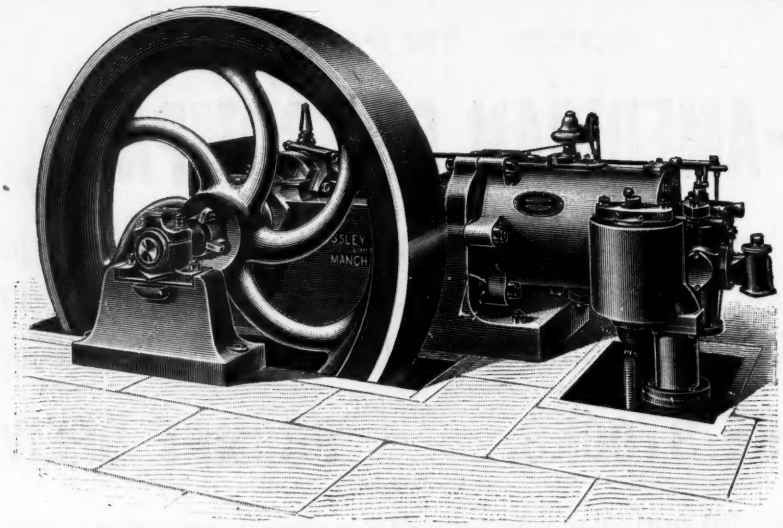

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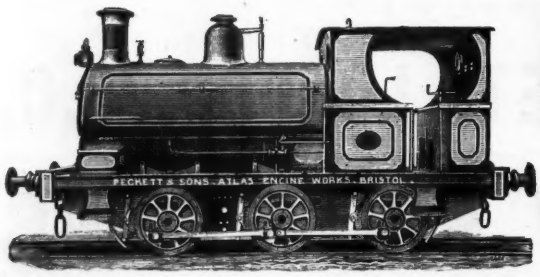

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RETORTS and FITTINGS, MOUTHPIECES with Self-Sealing Lids.

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DESIGNS, SPECIFICATIONS, and ESTIMATES FREE.

PIG IRON (Special Quality) for Engine Cylinders. GAS COAL famous for its UNRIVALLED EXCELLENCE.

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25 Candles per Cubic Foot of Gas.

This is the Burner exhibited at Niagara Hall, London, and throughout the Provinces.

The New Welsbach Burner is used without a Chimney.

Suitable for Indoor and Outdoor Lighting

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Price from 5/- upwards.

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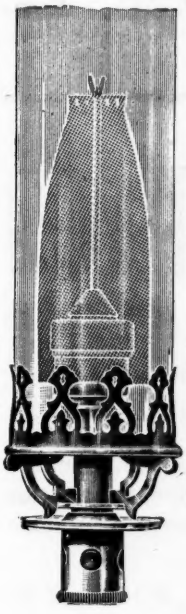

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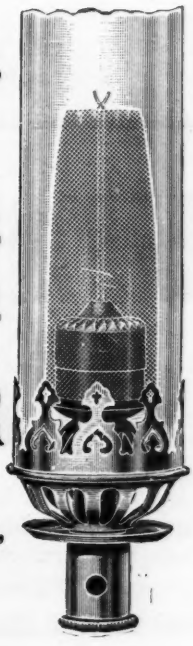

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A CHEAP FORM OF THE "C" BURNER.

50 to 60 Candle Power with $3\frac{1}{2}$ to $3\frac{3}{4}$ Cubic Feet of Gas,

Price complete with MANTLE and CHIMNEY, 4/-.

MANTLES FOR "YORK" BURNER, 1/- EACH.

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MORE GAS & SALEABLE COKE PER TON of COAL CARBONIZED is PRODUCED; SAVING CAPITAL, LABOUR, FUEL, WEAR & TEAR, &c.

THE ENRICHMENT IS INSTANTANEOUS AND PERMANENT.

The Carburettor is inexpensive, easily fixed, and entirely supersedes the use of Cannel.

SOLE AGENTS FOR REDWOOD & CLOWES' INFLAMMABLE VAPOUR & GAS DETECTORS.

Dealers in Carburine and all other Naphthas and Oils suitable for the Enrichment of Gas.

For Prices and full Particulars, apply to

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IMPROVED GAS GOVERNOR.

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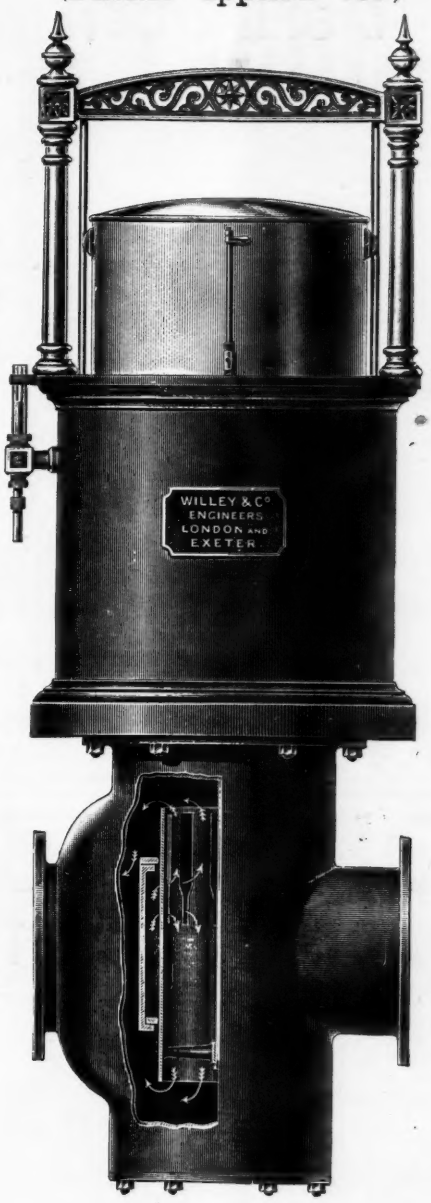
The Inlet Pressure having absolutely no effect on the open-ended cylindrical Valve, the pressure is maintained constant at the outlet **UNDER ANY CHANGE OF PRESSURE OR DRAUGHT**, and dispenses with the usual complicated balancing arrangements.



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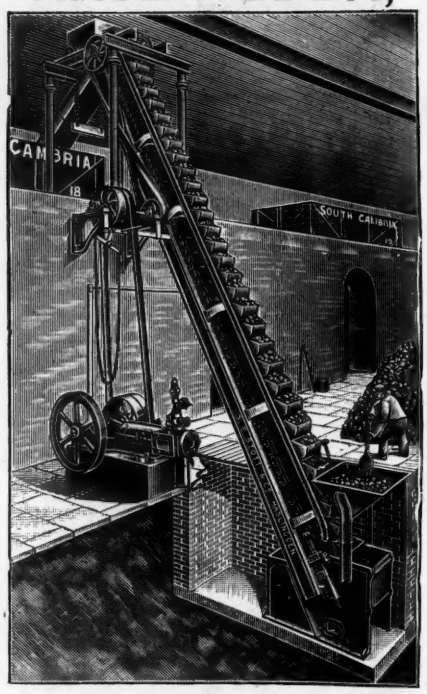

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HIGH-CLASS STEAM-ENGINES up to 1000-Horse Power.

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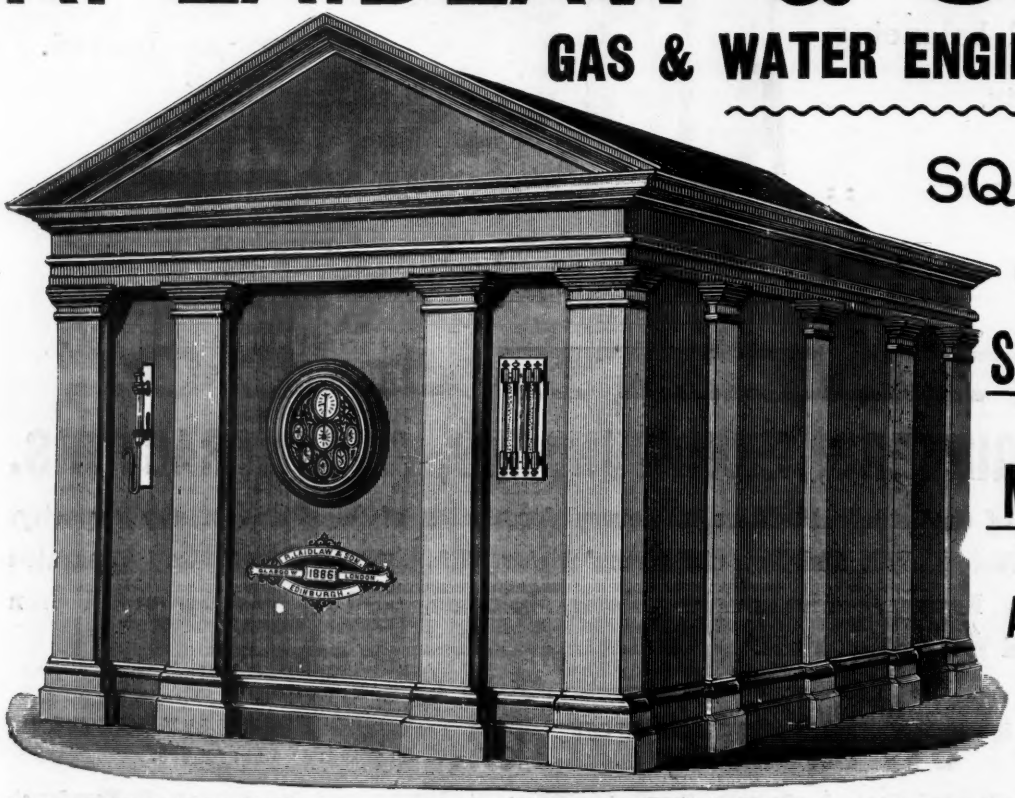

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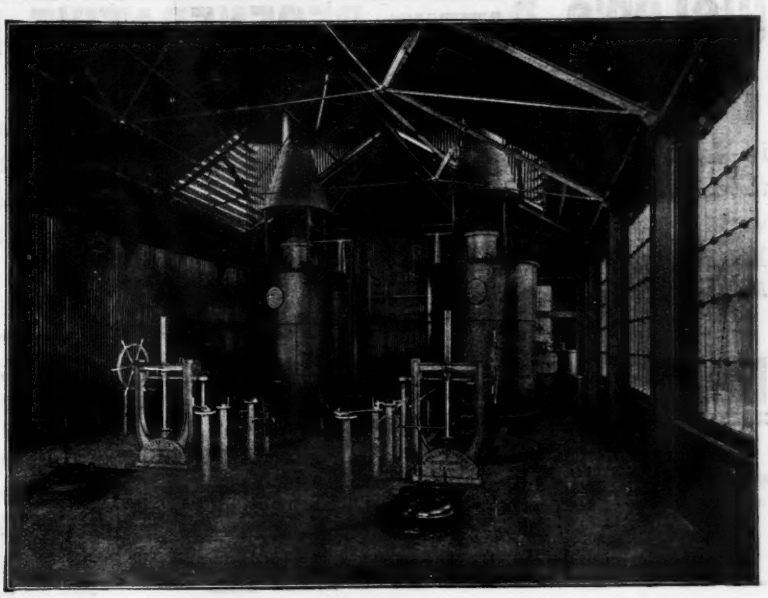
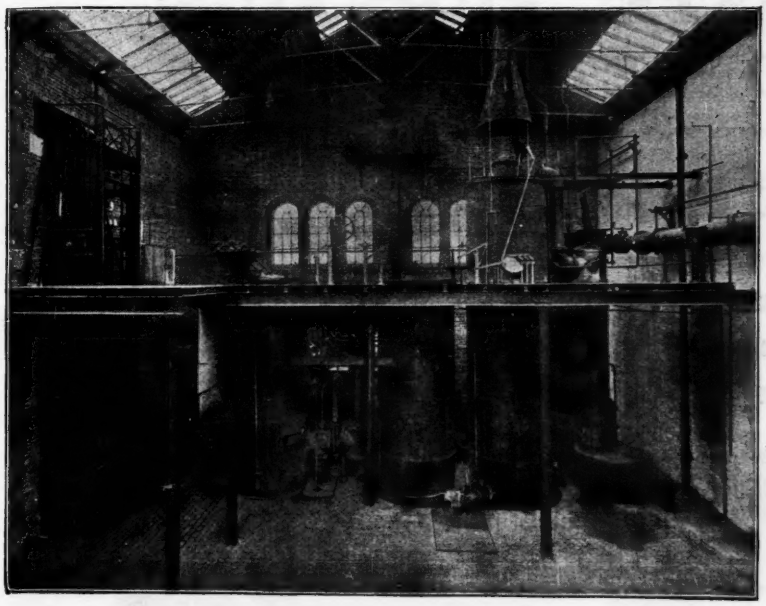


Water-Gas Plant at Southall.



Water-Gas Plant at Folkestone.

Carburetted Water-Gas Installations.

HORNSEY.
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EVERY DESCRIPTION OF
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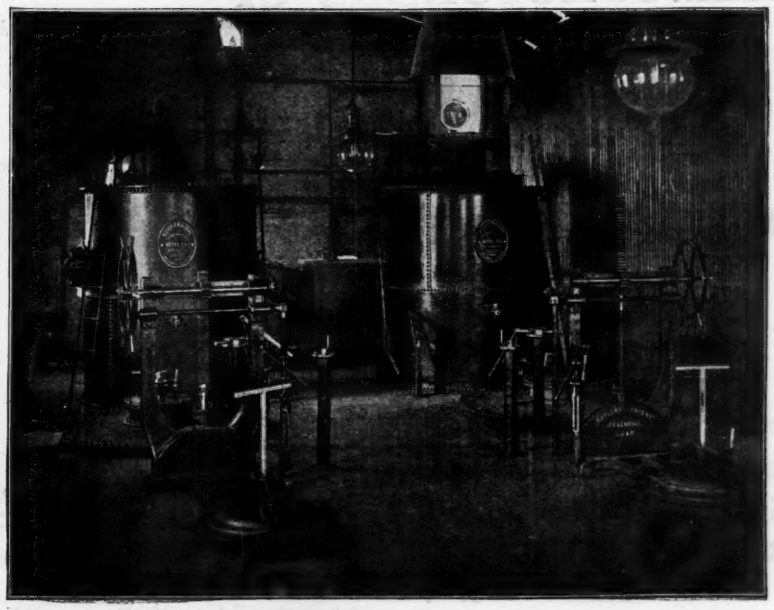

Water-Gas Plant at Southend.

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These Settings are Testified to and guaranteed to produce **more Gas per day,** to be more **simple** in **Management,** to have **greater Durability,** to be **more Economical** in **Labour** and **Fuel,** and to have the **Lowest Cost for Renewals** of any system in the Market. Gas Engineers and Managers would do well to give these advantages their careful consideration, when contemplating extension of their Retort-Benches, or when filling existing Ovens.

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NOTE: **The Agency held by Messrs. Drake & Son, Halifax, for England, Wales, and Abroad has now ceased; and they have no authority whatever to represent the Patentee, although persistently advertising themselves as Agents.**

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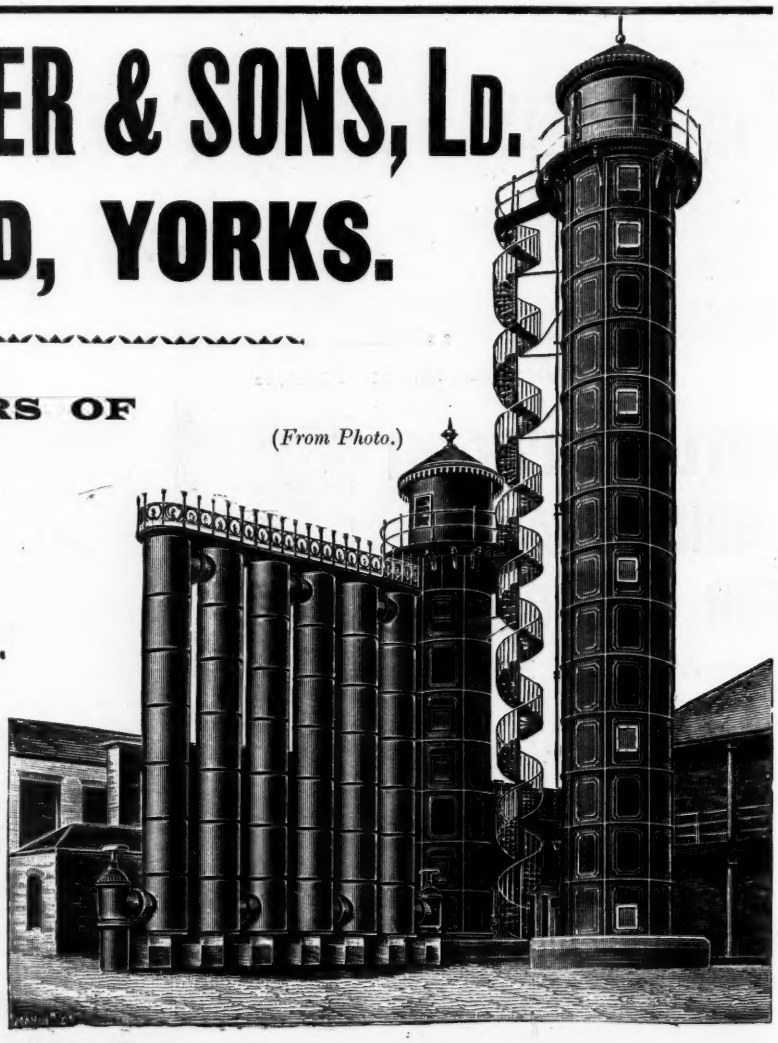
GAS PLANT

OF EVERY DESCRIPTION.

(*From Photo.*)



View illustrating Condensing and Scrubbing Plant erected for the Accrington Gas and Water Board by R. D. & Sons, Ltd.

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Antrim	Colombo
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Ascot	Cranbrook
Audley	Cullen
Aylsham	Deddington
Ballymena	Dewsbury
Ballyshannon	Dover
Beaumaris	Downpatrick
Bentham	Droitwich
Bewdley	Durban
Biddulph	Dursley
Bideford	East Ardsley
Birmingham	Eastbourne
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Blackwell	Ellesmere
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Bramham	Flint
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Bromsgrove	Gorey
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Cannock	Holywood
Cape Town	Honiton
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Castleford	Huddersfield
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Contractors to Her Majesty's Government, the Indian Government, the Natal Government, the Turkish Government, the Netherlands Railway, the London County Council, &c., &c.

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Guaranteed genuine and free from adulteration, and specially made to withstand Gaseous Fumes.

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Kilrush	Rugeley
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Kirkburton	Scarborough
Knutsford	Seaham Harbour
Leamington	Seisdon
Ledbury	Shifnal
Leek	Shipston-on-Stour
Leven, N.B.	Sidmouth
Limerick	Skibbereen
London	Slough
Loughborough	Southam
Lymington	Southend
Machynlleth	Stafford
Merthyr Tydfil	St. Albans
Milborne Port	Stamford
Minster	Storrington
Monte Video	Strood
Napier (N.Z.)	Stroud
New Mills	Sudbury
Newnham	Swinton
North Middlesex	Tetbury
Odiham	Tokio
Ogmore	Uppingham
Outlane	Uttoxeter
Parsonstown	Ventnor
Pembroke	Warwick
Penmaenmawr	Wexford
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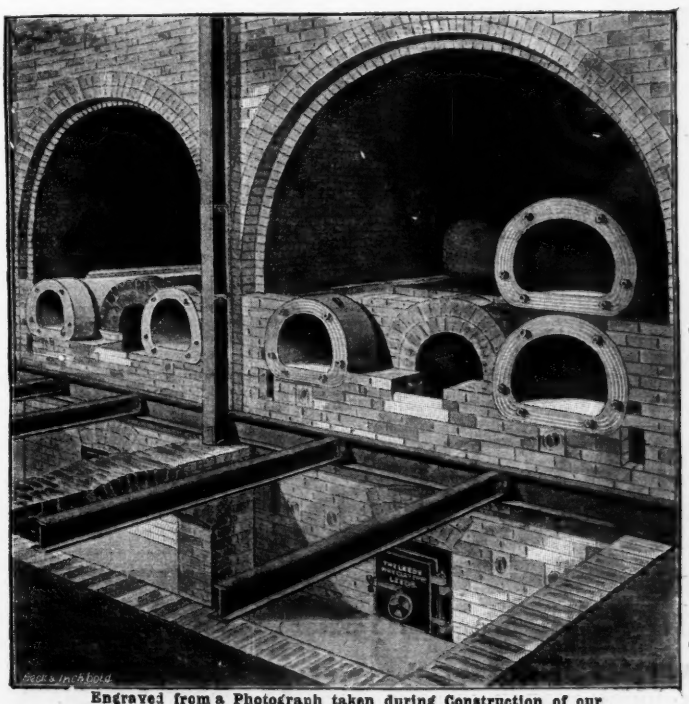

Engraved from a Photograph taken during Construction of our Shallow Regenerator Settings.

RETORT-SETTINGS

OF EVERY DESCRIPTION

INCLINED, HORIZONTAL,

REGENERATOR, GENERATOR,

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SHALLOW REGENERATORS A SPECIALITY

MANY INSTALLATIONS.

EXCELLENT RESULTS OBTAINED.

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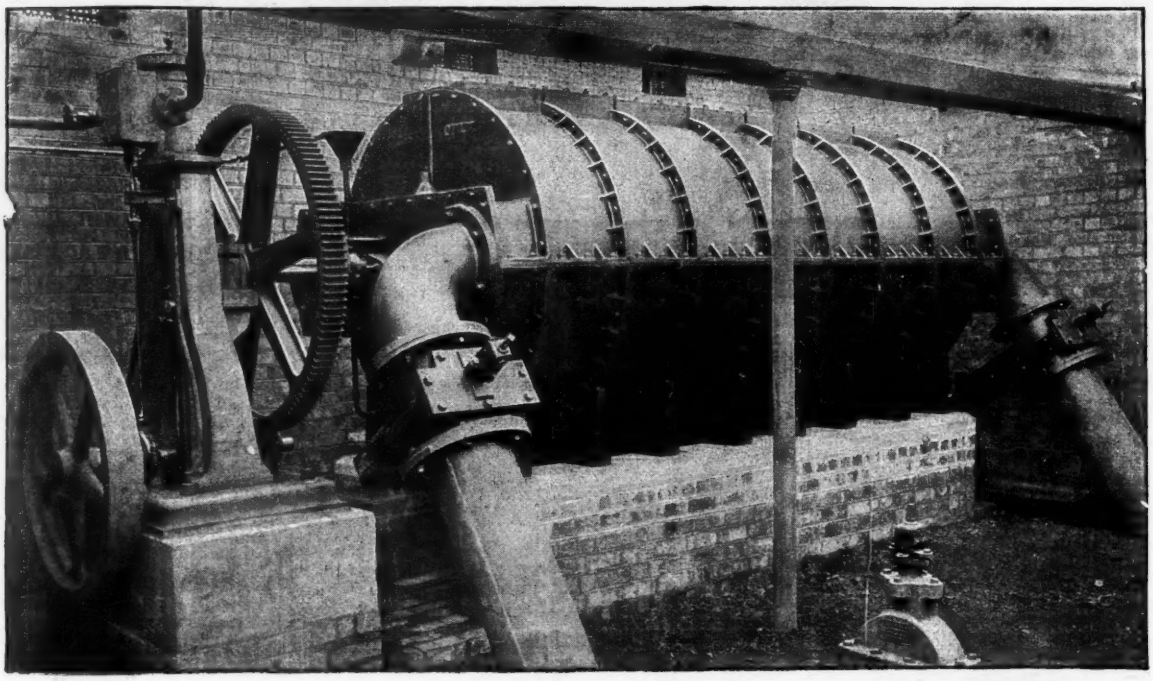

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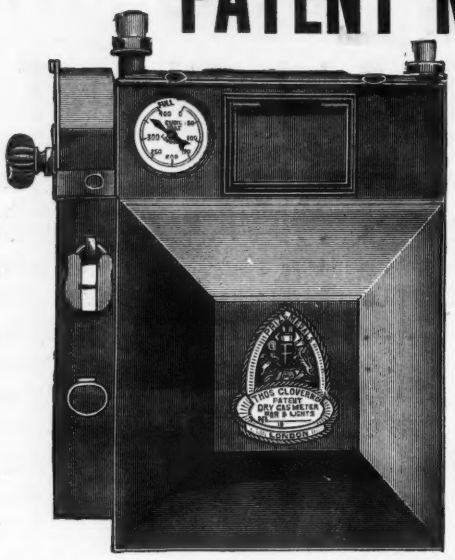

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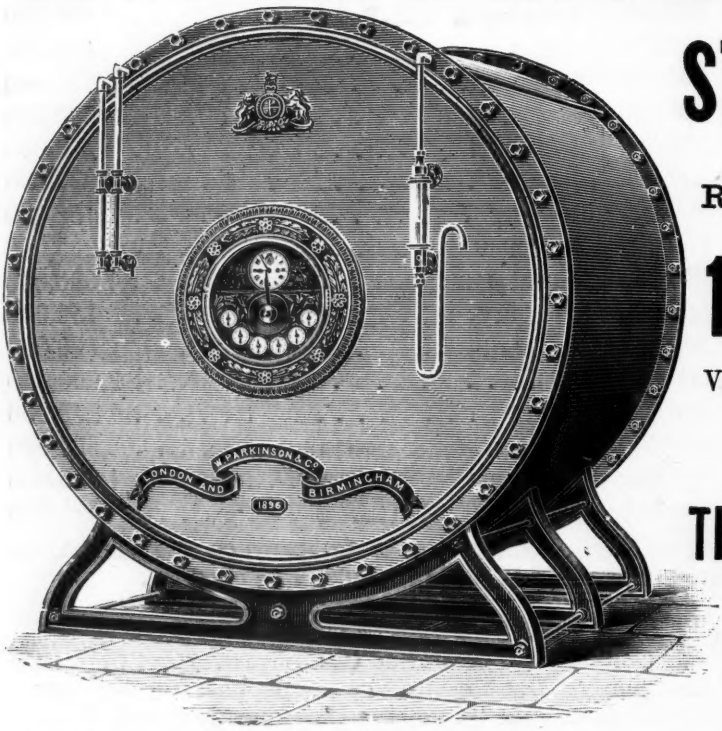

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EDITORIAL NOTES.

Metropolitan Gas Affairs in Parliament.

THE third reading of the Bill of The Gaslight and Coke Company was opposed last Thursday, when it came on in the regular course among the orders of the day. This unusual proceeding was due to the fact that the labours of Sir James Rankin's Committee have not terminated; and in the course of the debate which was sprung upon the House, and delayed the business of the sitting for nearly an hour, it was allowed to appear that the work of this Committee is regarded as mainly directed to the investigation of the operations of this Company. The plausible argument was several times repeated, that, if the Money Bill were permitted to pass, the appointment of Sir James Rankin's Committee would be stultified. On the other hand, the Bill has been considered by a Committee, and the preamble declared to be proved. It would be indeed a process of stultification of the procedure of the House, if the deliberate judgment of a Private Bill Committee were to be subject to deletion for the reason relied on in this case. For this was the issue: A Committee had decided that the Company ought to have additional capital in order to discharge their responsibilities to the public; and to delay the third reading of the Bill sanctioning the new issue would have prevented its passing through all its stages this year. Consequently, upon the general principle that the House should support its Committees, the Government asked for the Bill to be read the third time, which was accordingly done, though by much less than the normal Government majority. There can be no question of the reason for this purely formal victory of the Company over their opponents. Our report of the debate is not pleasant reading.

Sir James Rankin's Committee met again on Thursday, and the Gas Companies' evidence was opened by Mr. H. E. Jones. It does not appear how the order of the witnesses is settled; but one may easily believe that there will be considerable manœuvring for the advantage of the "last "word." Mr. Jones had to confine himself closely to the circumstances of the Commercial Company, and he made out a very good case for the administration. The price of gas in the Commercial district is generally about 3d. above the South Metropolitan figure, for reasons not difficult to define. At present the difference is 4d., because the Company have not been able to follow the South Metropolitan in taking off the last penny. The Commercial district lies within a ring-fence; and the prospect of expansion in the ordinary way can scarcely be said to exist. The introduction of the prepayment meter opened up a new line of business; but it is not a very paying one, especially when the heavy extra capital expenditure has to be provided for under obsolete conditions. Mr. Jones very fairly took credit to his Company for the light capital burden—£425 per million cubic feet of gas sold, which has been the salvation of the undertaking. Mr. Jones was also careful to inform the Committee that the effect of the sliding-scale in the case of his Company is that of all economies on revenue account, 84 per cent. goes to the consumers, and only 16 per cent. to the shareholders. In order to shorten the time occupied by the inquiry, the Committee have arranged to sit twice a week for the future.

Belfast in Parliament—Gas Discounts and Main Laying.

THE Belfast Corporation Bill has been in Committee of the Commons during the past week. The part relating to gas contained several proposals for altering the settlement under which the undertaking has been carried on from a period anterior to its acquisition by the Corporation. These proposals were very strongly opposed, and the event was not favourable to the wishes of the Corporation. The first of these disputed matters was the system of consumers' discounts. By the Belfast Gas Acts, 1852 and 1874, and an Improvement Act of 1878, it was made obligatory upon the Gas Commissioners to allow quarterly discounts varying from 2½ up to 20 per cent., according to the consumption. These discounts originated during times when the old Gas Company were charging 8s. per 1000 cubic feet for their gas. It was then a "day of small things" with them; and the Directors were only too glad to win the custom of the big millowners by offering such terms as would induce the latter to give up the private gas-works which many mills possessed. When the city acquired the gas-works, in 1874, the terms of discount were left undisturbed, so as not to awaken the enmity of the big consumers to an operation

which at the time was not supported by a particularly strong body of public opinion. The nominal price of gas has been continuously reduced by the enlightened Belfast Corporation, until it now stands at 2s. 3d. per 1000 cubic feet, and no meter-rent. Still the statutory scale of discounts has remained in force; and so it has come to pass that what was a permissible inducement to large consumers when the price was comparatively high, is actually an unfair preference with gas selling at little more than the cost of production.

It will be seen from this explanation that the great question of high discounts for large gas consumption was raised in its acutest form by this Belfast Bill. Consequently, the manner in which the subject was dealt with by the Committee is of very general interest. The Corporation found themselves in this position: Owing to the effect of the highest rate of discount (20 per cent.) in reducing the price paid by the largest consumers to within less than 2d. per 1000 cubic feet of the cost of manufacture, any further reduction of the price to the small consumers has become impossible. The cost of manufacture in Belfast is, roughly speaking, 1s. 8d. per 1000 cubic feet. The Corporation could therefore safely sell at an all-round price of 2s. per 1000 cubic feet; and even allow a cash discount of 5 per cent., if only they were relieved from the obligation to allow the large consumers these extreme discounts. This was the proposition made by the Bill; and it was opposed by some of the largest consumers. The evidence taken by the Committee on this point is of a very valuable character; the testimony of Sir Samuel Black (the Town Clerk) and Mr. James Stelfox reading like a particularly well-pointed essay on the subject. The issue was clearly put—that the principal reason for reducing the discount was to enable the smaller consumers to get cheaper gas. The Lord Mayor and another member of the Corporation told the Committee that the proposal commanded the assent of the majority of the people of Belfast. On the other side was (among others) the representative of the Northern Counties Railway Company, who incidentally informed the Committee that the adoption of electric lighting by the Company had only diminished their gas consumption "to a very small extent." The opposing Counsel argued that the large and growing employment of gas for motive power in the city would suffer a check if the large consumers were deprived of their present advantage. The Harbour Commissioners also objected to the alteration; and the result of two days' controversy was the rejection of the proposed clause.

Another matter which the Corporation sought to correct by their Bill was the obligation imposed upon them by section 138 of the Belfast Water Act of 1840 to keep their mains as far away as possible from any water-main in the same street. After having been dormant for many years, this ancient provision has lately given the Gas Commissioners a good deal of trouble. The Act requires a minimum distance of 4 feet between the gas and water mains; but under the conditions of crowding the subsoil with all sorts of pipes and cables that have supervened of late years, this regulation has become impossible. The Belfast provision in this regard was repeated in the Metropolis Gas Act, 1860 (clause 50). It never became general, and has, in point of fact, remained a dead letter from the beginning. The underlying idea was that this regulation was required in the interests of sanitation; but this has proved to be unfounded. Gas companies are placed by the Act of 1847 under stringent obligations not to foul water; but there has never been a case of fouling in the way contemplated by the Belfast legislation. Practically, this is admitted by water supply authorities, who never hesitate, when it suits their purpose, to put in their pipes alongside of, or across, gas-mains. It has, in effect, come to be a question of keeping a certain amount of "elbow room" for mains, for convenience of access in case of repairs, &c. Eventually, the Belfast authorities concerned agreed upon a "give-"and-take" clause, in which the regulation distance for the mains is put at 2 feet; but this is reducible by consent.

Alleged Pollution of a River by Water-Gas Tar.

LAST week we began a report of the important case of *Carr and Co. v. The Bath Gaslight and Coke Company*, which was an action in Chancery to restrain the defendants from polluting the River Avon. The cause of the pollution was alleged to be tar from carburetted water-gas plant, which had escaped from the defendants' works. There was the usual conflict of evidence, which is inseparable from an issue of this kind. The difficulty of getting at the rights of the case was considerable; but it was not denied that water-gas tar had found its way into the river. This admission might be supposed to simplify matters; but the position of the parties to the action was rendered doubtful by the circumstance of the river being little better than an open sewer. The water was polluted by all kinds of manufacturing refuse; but it was stated that the plaintiffs did not mind this. The only thing that injured them was the water-gas tar. Again, it was acknowledged that the Company had stopped the nuisance. Consequently, the plaintiffs gave up the idea of obtaining an injunction; and the claim was reduced at last to a request for an inquiry as to damages, with liberty to apply, and for costs. The questions left for the Judge were, first, whether the plaintiffs had a good cause of action against the defendants. Upon this the defence rested upon the contentions that the plaintiffs had failed to show that they had suffered any damage attributable to water-gas tar, and that there was no proof that the tar came from the gas-works. As to this the Court held that the question of law was not whether any damage had actually been done, but whether there was in the river water a polluting substance of which the plaintiffs had a right to complain. If this is the law, of course, the result is obvious. The tar was there; and it must have come from the gas-works, for the simple reason that there was nowhere else for it to have come from. With respect to the inquiry as to damages, the plaintiffs are offered it at their own risk, but without liberty to apply, as the cause of the trouble has been removed. The upshot of the matter is that the Gas Company have to pay the costs of the action, which is probably as much as the other side wanted. It was clearly not a bad case; but the proceedings have given a great deal of trouble to a large number of people. The chief point of the judgment, for general application, is the dictum that in cases of this character an action for an injunction will lie if it can be shown that something wrong has been done, although specific injury may not be demonstrable.

Compulsory Purchase of a Gas Undertaking.

A STRONG decision, which if not precisely a precedent is equally noteworthy, has been put upon record by the House of Lords Committee on the Loughborough Corporation Bill; the Corporation having been granted power to purchase the undertaking of the Loughborough Gas Company against the wishes of the Company. The Company had in Parliament a Bill of their own for increasing their capital; and the Corporation deemed the occasion opportune for compulsorily acquiring the property. There was no serious complaint as to the manner in which the works had been carried on; but the Corporation thought that, as a matter of policy, they ought to have the gas supply in their own hands. The House of Lords have consented to this wish. It was stated in evidence that the acquisition of the gas-works had been a point of local municipal politics for years; and the Corporation seem to have been elected upon this "ticket." As against this demand, the Company merely asked the Committee to leave them alone, in the enjoyment of their own property. A few years ago, such a request would have met with a considerate response. Times have altered, however; and the Loughborough gas undertaking is to change hands for this reason more than any other. If the Company's Bill had passed, the existing opportunity for transferring the property upon its actual basis of value would have slipped away, perhaps never to return. Thus, at any rate, the Committee appear to have argued; and the result is as stated. The Committee almost contemptuously rejected the advice and the warnings of Counsel with reference to the Morley example of last session—declaring that they intended to decide the Loughborough case upon its merits. The decision is of a momentous character, and will probably give a strong impetus to enterprises of a similar kind in the future.

Gasholder Destroyed at St. Helens.

THE sympathy of the entire gas engineering profession will be engaged on account of the owners, the staff, and the employees of the St. Helens Corporation Gas-Works, which suffered cruelly from the disastrous explosion of a neighbouring chlorate of potash factory last Friday. A description of the damage done and the general nature of the accident will be found in another column. Here we are only concerned to comment upon the effect of the

explosion upon the gasholders, from the point of view of the public safety. It happily struck the representatives of the Liverpool newspapers that the right man to ask about what happened to the gas-works was Mr. Samuel Glover, the Manager; and the result was to provide the readers of those papers on the following day with a clear and authoritative statement which amply satisfies all reasonable curiosity in this regard. One of the gasholders, which had about 250,000 cubic feet of gas in it at the time, had its crown broken through. The escaping gas ignited and burnt out quietly, in a great flame which must have been impressive while it lasted. Mr. Glover and his men had been put upon their guard by the fire which preceded the explosion; and, with great courage and devotion to duty, all hands obeyed the Manager's instructions for keeping the apparatus clear of the falling and burning rubbish. The circumstance of the atmosphere of the works being rendered almost insupportable by the escaped chemical fumes greatly aggravated the personal risk of those who thus stuck to their posts. We notice that some of the newspapers have held up the gas-works as an addition to the dangerous elements shown by this event to exist normally in a manufacturing centre like St. Helens; and yesterday's "Daily News" refers to the fact of the gasholder having burnt out instead of exploding as a piece of "great good fortune." It was nothing of the kind. It is time that newspaper reporters should learn that the gas stored in a holder cannot "explode" by any known means. Indeed, the intelligence of what happened to the St. Helens Gas-Works, as an effect of one of the most tremendous explosions known in all industrial history, should tend to reassure the public that, while gasholders are liable, like all other structures, to suffer damage from disasters of this nature, they cannot contribute any material addition to the general mischief.

The Millwall Dock Scandal.

On Saturday, at the Central Criminal Court, Colonel Raymond Birt, formerly Manager and recently Managing Director of the Millwall Dock Company, was sentenced to nine months' hard labour for having falsified, to a very material extent, the accounts of the Company, of which it was admitted he had had sole and unrestricted control. The facts of the case have been fully reported in the Daily Press, and are doubtless familiar to most of our readers. We do not propose to retell the story of the frauds, but rather to draw attention to one or two of the features of the case which have served to make it especially remarkable and instructive.

The most striking facts in this unhappy business are the magnitude of the falsifications (the assets of the Company being overstated by nearly a quarter of a million pounds); the apparent lack of sufficient motive for these falsifications; the extended period—something like a quarter of a century—during which the system of cooking the accounts had been carried on; the extraordinary innocence (or the blindness which will not see) of the staff who carried out the system under the instructions of Mr. Birt; the high character and reputation formerly borne by the prisoner; and the absolute child-like faith reposed in him by his fellow-Directors and by the Auditors. It is to the latter points that we wish to call particular attention; and if the case should result in impressing upon the minds of all interested in the management of large business concerns the criminal folly of allowing any man, however spotless his reputation, to have absolute control of any undertaking, and further in bringing home to the Auditors of such companies the utter uselessness—indeed, the possible disastrous consequences—of relying upon the unproved word of any one man, however high the position he may occupy, for the accuracy of the accounts it is their duty to examine and certify, much good will have arisen out of the evil which has befallen the Millwall Company and their unhappy Director.

It is becoming a commonplace of prosecutions for fraud or embezzlement that evidence should be given (with the intention of mitigating, but with the effect really of aggravating, the offence) to show that, until he was found out, everyone reposed the utmost confidence in the prisoner, and that his honesty was not for a moment suspected. It is a lesson that should be taken to heart by all employers; and they should, in the interests of their servants as well as in their own, be careful not to lead those servants into temptation by neglecting to keep a proper watch and check upon their conduct. The object of the frauds in question appears to have been in great part to earn and maintain for the defaulter a wide reputation for successful management; and this temptation lies in the path of every manager. Let there be a bad year, and let there be no apparent fear of any discovery if the assets be just a bit over-stated, in order to carry some of the loss over to the next twelve months, which it is fondly hoped will be more prosperous—the gambler's devil-inspired will-o'-the-wisp of "going to get it back on the next race"—and it needs a stiff backbone and an honour unaffected by vanity to withstand the temptation. "Let him that thinketh he "standeth take heed."

Finally, the most serious and instructive lesson is the one for Auditors—a subject on which we have recently dwelt at some length. We will only now point out that, if the Millwall Docks audit had been of a searching, instead of a ridiculously inadequate, character, the falsification of the accounts would not merely have been discovered long ago, but would, most probably, have never been attempted. The prosecuting Counsel—Mr. Carson, Q.C.—appeared to think he had entirely exonerated the Auditors from any shadow of blame by saying that, "of course, he supposed, "the Auditors were never intended to go through the 200 "cargo-books and the 12,000 accounts which they con-"tained." We grant that they could not be expected to check all the books and all the accounts. But they should at least have examined some before assuming the accuracy of the whole; whereas it appeared in evidence that they never even saw one of these books, or examined a single account therein with the abstract of the ledgers from which, when falsified, the revenue-books were prepared. "The "revenue-books were the books which were placed before "the Auditors. . . . There was also a certificate pro-"duced to the Auditors, sometimes signed by Mr. Wood, "and generally by Mr. Birt, stating that the revenue-books "accurately contained the amounts appearing in the cargo-"ledgers!" And on the strength of such an examination they signed the accounts! Could human faith and trust—or human stupidity—go further? After this the dupes of the "confidence-trick" need not stand alone.

A Wharf not a Factory.

A highly important decision of the Court of Appeal, relating to the case of *Hall v. Snowdon, Hubbard, and Co.*, under the Workmen's Compensation Act, touches the interest of all those who have to do with horses and carts and wharves. The original action was dismissed by the Judge of the Bloomsbury County Court, and his judgment was upheld on appeal. It was brought by the son and only dependent of a carman who died from an accident arising out of his employment of hauling soil away from a wharf on the Regent's Canal. It might have been coal, or anything else. As a matter of fact, it was earth taken from a trench in which a water-main was laid; and the carter was leading his horse and cart out of the wharf into the street. He was walking backwards, and did not see that he was backing against a trolley load of water-pipes standing in the street. He was crushed between the cart and the pipes, and killed. The claim was resisted on the ground that the wharf was not a factory within the meaning of the Act. Counsel for the appellant endeavoured to show that a wharf is a factory, whether it has machinery attached to it or not, by virtue of the definition of the word "factory" in the Factory and Workshop Act, 1895. The chain of implication is as follows: Section 7, sub-section 2, of the Workmen's Compensation Act, 1897, declares that "In this Act 'factory' has the same meaning as "in the Factory and Workshop Acts, 1878 to 1891, and "also includes any dock, wharf, quay, or warehouse, "machinery or plant to which any provision of the "Factory Acts is applied by the Factory and Workshop "Act, 1895, and every laundry worked by steam, water, "or other mechanical power." Section 23 of the Factory Act, 1895, said that certain provisions of the Acts should have effect as if every dock, wharf, quay, and warehouse were included in the word "factory." Among the provisions so specified were those of section 18 of the Factory Act, 1895, as to notices of accidents; and those of section 68 of the Factory Act, 1878, as to inspection. All these provisions apply as much to an ordinary wharf as to a wharf to which dangerous machinery is attached. Wherefore Counsel contended that the wharf in question came within the scope of the Workmen's Compensation Act.

Counsel on the other side argued that if every wharf was to be deemed to be a factory within the Act it would have been so stated by the Legislature. The reference to section 18 of the Factories Act, 1895, failed because this clause deals only with an accident occurring "in" a factory, not "about" it. Neither does section 68 of the Act of 1878 apply to the case of a man who happens to be on a wharf in the ordinary course of his employment. The Appeal Court held that an ordinary wharf is not a factory within the meaning of the Workmen's Compensation Act.

WATER AND SANITARY AFFAIRS.

A SINGULAR but salutary *quietus* has been given to the expectation of which we made mention last week, that the Select Committee of the House of Lords on the Metropolitan Water Companies Bill of the Government would allow the introduction of a clause to meet the views of the Hertfordshire County Council as to the abstraction of water from their district. A clause of this nature was said to have been agreed upon between the Government and the Hertfordshire Council, by which it would be provided that nothing in the forthcoming Act should authorize the construction by a Metropolitan Water Company of any works in the county of Hertford outside the water limits of the London Companies. Mr. Littler, on behalf of the associated Companies, strongly opposed the amendment; while Mr. Fitzgerald, representing the promoters, said it was not known that the Companies would object to the clause. Yet he was constrained to own that there was an old feud between Hertfordshire and the London Companies as to the abstraction of water from the county, on which point he expressed an opinion that it was only reasonable to insert a clause for the adequate protection of the county. Notwithstanding all that was said for the clause, the Committee declined to accept it; and they also rejected another of the same description that was afterwards placed before them. At the next sitting of the Committee, Hertfordshire returned to the attack; Lord Robert Cecil proposing a general clause which it was said would protect other counties as well as that of Hertford. Earl Cowper was called to bear witness to what Lord James had said in the House of Lords, showing that the Bill was not intended to confer powers for drawing an increased quantity of water from the county. At this stage the Chairman prudently took shelter behind the Local Government Board; saying that, before considering the insertion of any clause such as was proposed, the Committee must be satisfied that Mr. Chaplin had assented to it. On the next day it was stated that Mr. Chaplin did not see his way to agree to any further amendment of the Bill. Lord Ribblesdale thereupon signified that the Committee did not want to hear anything more, and the Bill must remain absolutely as it was. So ended the latest attempt of Hertfordshire to interfere with the *status quo*, and to curtail the rights of the New River and East London Companies in regard to their sources of supply. There was nothing to show that fresh powers were about to be conferred upon these Companies, though the opposition was founded upon a plea that such extension would be authorized by the Bill. It would be a strange piece of inconsistency to make this measure a means of restricting the supply which London so especially needs, and which the Bill was intended to promote; being brought forward, as Lord Ribblesdale remarked, "for the benefit of the public." We should rather like to know what foundation there was for the statement that the Government and the Hertfordshire County Council had agreed upon a restrictive clause. Mr. Chaplin had evidently not given his consent to it, although Mr. Fitzgerald argued in favour of such an amendment. Apparently some parties who ought to have known what they were about spoke without the book.

Mr. Stuart went a little outside the region of fact last Friday, when he cited the authority of the Royal Commission for the insertion of a clause in the East London Water Bill to preclude the Company from making any claim in respect of advantages conferred on them by the passing of the Act, supposing the undertaking to be purchased compulsorily within the next seven years. The interim report of the Commissioners went no further on this point than to propose that no Company should be allowed, in the event of purchase, to enhance the value of their undertaking "by "reason of an intercommunication scheme." According to Mr. Stuart's own showing, the Bill before the House "not "only facilitated intercommunication, but gave power to "withdraw additional water from the Thames, and to make "certain reservoirs with the object of providing for the in-"creasing population of the East-end of London." These elements in the Bill clearly removed it out of the restricted sphere of a mere intercommunication scheme, described by the Commissioners as intended solely "to protect the water "consumer from inconvenience." The London County Council pleaded before the Commission that the effect of any scheme of intercommunication might be to increase the value an arbitrator would put upon the undertakings of the Companies in the event of purchase by some public authority. But the Commissioners, in their report, expressed a doubt whether any such apprehension was well founded, and only suggested that it would be well that any uncertainty as to the matter should be removed. Upon this very slender thread Mr. Stuart made his plea depend, that the report of the Royal Commission could be invoked in support of his proposal for inserting the seven-years clause in the East London Bill. We do not always find Mr. Stuart particularly anxious, as in the present case, to carry out what he conceives to be a decision on the part of the Royal Commission. The same authority considered that the capital to be raised for the purpose of an intercommunication scheme might properly be made exempt from the obligations of a sinking-fund clause. Mr. Stuart and his friends thought otherwise, and fought for a sinking-fund clause in the case of the Government Bill, but without any success, though, by a strange misconception on the part of Lord Ribblesdale's Committee, a clause of this kind has been inserted in the Bill while passing through their hands in the House of Lords. Mr. Chaplin himself drew a distinction between his own intercommunication scheme and that which was included in the now abandoned Bill of the Water Companies. The latter Bill, he showed, went further than his own. If such a distinction could be drawn, much more is it applicable between a mere intercommunication scheme as contemplated by the Royal Commission, and the Bill brought forward by the East London Company. Concerning the seven-years clause, we observe that the Parliamentary Committee of the County Council, in their report to be presented at the meeting to-day, say they regard such a proviso as of the greatest importance. Hence the contention raised over the amended Bill last Friday, which was looked upon by Mr. Chaplin mainly as an attempt to obtain the rejection of the measure. He also gave Mr. Stuart to understand that the Local Government Board were not averse to the progress of the Bill, though Mr. Stuart had argued that there was an indication of something to this effect. The contentious nature of the opposition was shown by the circumstance mentioned by Sir Joseph Pease, that seven years would elapse before any one of the new reservoirs was in working order. Finally, the House of Commons showed its appreciation of the subject by voting more than two to one against the amendment for inserting the seven-years clause. But the County Council will go on fighting nevertheless.

It appears from a communication from the Paris correspondent of the "Pall Mall Gazette" that typhoid fever has since the beginning of the year been far more prevalent in the city than is desirable; and there is reason to fear that the water is at fault. On reading this statement, one naturally jumps to the conclusion that there has been a shortage of water, and that the Seine has had to be sesorted to for making up the quantity. This has not been ran unusual occurrence. But it is not the case now. The districts specially affected are those supplied with water supposed to be obtained from the sources of the Avre, which have only recently been tapped at a cost of about 30 million francs; and should these be contaminated, the responsibility will lie upon the authorities. The evidence certainly points to a serious mistake having been made, and, according to our contemporary's correspondent, it is one which is peculiarly typical of French officialdom. The intention was to use the "sources" of the Avre for augmenting the supply of potable water to Paris; but it seems that the river has the peculiarity of occasionally disappearing underground, and so being lost sight of. The consequence has been that the stream has been tapped at a point below its source. This blunder is characterized as an "egregious "piece of official jobbery." Everybody knows that the

Ponts et Chaussées is a very powerful body, the Engineers of which are highly accomplished gentlemen in their own special line—that of road-making and bridge-building. But it does not necessarily follow that they are the right people to be entrusted with the work of obtaining water for the supply of a large city like Paris. However, the institution has an official status, and consequently much influence. It was desirous of getting hold of the work; and it was successful. But what has been the result for the Parisians? Our contemporary's correspondent says they have not got spring water but "a solution of sewage." They have, however, he remarks, the consolation of knowing that it is conveyed to them over magnificent aqueducts and by a perfect system of canalization; this being work which the Engineers of the Ponts et Chaussées thoroughly understand.

The Acetylene Exhibition at Buda-Pesth.—Last Saturday was the day fixed for opening this exhibition, to which reference has been already made in our columns. In connection therewith, a congress will be held which will open on the 20th inst. A large number of subjects will be brought under consideration; among them being "The Lighting Power of Various Gaseous Mixtures containing Acetylene, which will be introduced by M. Guilbert, Assistant-Director of the Laboratory of the Western of France Railway. Discussions will be held on several afternoons up to and including the 28th of May; and there will be an excursion on the 22nd.

Southern District Association of Gas Engineers and Managers.—The spring meeting of the Association will be held next Thursday, when the members will visit the Tottenham Gas-Works, and inspect the installations of water-gas plant, hydraulic stoking machinery, &c., under the guidance of Messrs. Broadberry; after which they will take luncheon, at the invitation of the Chairman and Directors of the Company, at the Red Lion Hotel. In the afternoon, the members will be conducted over the Government Small Arms Factory at Enfield; and the day's proceedings will close with a drive to Chingford, where high tea will be served at the Forest Hotel.

British Association of Water-Works Engineers.—The Secretary of the Association (Mr. W. H. Brothers) has issued a preliminary notice in regard to the fourth annual meeting, which is to be held on June 5, 6, and 7. The first two days will be devoted to business; and for the purpose of the proceedings, the Council of the Geological Society have courteously granted the use of their rooms at Burlington House. The following papers have been arranged for: By Dr. Thresh, on "The Saline Constituents of Water from the Chalk;" by Dr. Kemna, on "The Biology of Sand Filtration;" by Mr. Peirce, on "Auxiliary Town Supplies." A suitable programme is being planned for Wednesday; and the annual dinner will be held in the evening.

The Discovery of Natural Gas at Heathfield.—In the "JOURNAL" for June 14 last year we gave an account of the discovery of natural gas in the parish of Waldron, Sussex; the particulars there presented having just been laid before the Geological Society by Mr. C. W. Dawson, F.G.S., who first brought the matter under public notice in the pages of "Nature." On that occasion, the light-giving power of the gas, when employed in conjunction with incandescent burners and mantles, was effectually demonstrated by Mr. C. E. Masterman, General Manager of the Denayrouze Lighting Syndicate; and suggestions were thrown out that it might be successfully piped to Hailsham, Eastbourne, or Tunbridge Wells, and then used for the illumination of these places. We ventured to question the practicability of this; but admitted the possibility of the gas being utilized for the lighting of Heathfield. Mr. Dawson now says that the Engineer of the London, Brighton, and South Coast Railway Company have decided to make an experiment of lighting the Heathfield Station with the gas, using incandescent burners. Several of the Directors of the Company have shown great interest in the discovery.

Utilization of Blast-Furnace and Coke-Oven Gases.—At the recent meeting of the Iron and Steel Institute, M. Disdier, of Bilbao, read a paper on the above subject. He remarked that the economy which would ensue upon the direct application of blast-furnace gases to the production of power by the gas-engine was of great importance. The coke-oven also should be utilized as a gas-producer, and therefore as a power-producer. Far-reaching changes might be expected when coke-ovens and blast-furnaces were placed side by side, forming a complete plant. Steam-boilers, steam-engines, steam-pipes, and gas-producers would be dispensed with, and would be replaced by a gas-main, through which coke-oven gases would be distributed to furnaces and gas-engines. A central station, with dynamos driven by gas-engines, might also distribute electricity to electro-motors scattered about the works to replace several of the present steam-engines. Excellent gas-engines, rated up to 250-horse power, and capable of being worked with coke-oven gases without modification of the ordinary form, had already been built; and their general adoption was only a matter of time.

INSTITUTION OF GAS ENGINEERS.

PROCEEDINGS AT THE GENERAL MEETING,

HELD AT THE

INSTITUTION OF CIVIL ENGINEERS,

MAY 2ND AND 3RD, 1899.

Mr. F. D. MARSHALL, of Copenhagen, President.

PAPERS AND DISCUSSIONS.

(*Continued from p.* 1208.)

NOTES ON MODERN SYSTEMS OF RETORT HEATING.

By G. P. LEWIS, of Lower Sydenham.

The several advantages claimed for the use of gaseous fuel in retort-settings are now almost universally conceded, and indeed its employment is absolutely essential to the success of the "inclined" system. It would therefore be only waste of time to reiterate the arguments adduced in support of its value for such a purpose. There is, however, still considerable divergence of opinion in regard to the value of recuperation, the use of steam under generators, &c. The author has therefore limited this communication to the consideration of such points as form the subject of debate at the present time, with the hope that the suggestions set forth will lead to a useful discussion.

RECUPERATORS.

Classification.—For convenience of comparison, recuperators may be grouped into three classes, according to the degree of recuperation attempted.

Class.	Designation.	Characteristics.	Percentage of Total Heat available in Setting, Utilized in Carbonizing.	Chimney Loss.	Relative Figure of Economy.
I.	Simple recuperation.	Secondary air heated.	58	28	0·84
II.	Double recuperation.	Secondary and primary air heated.	68	16	1·00
III.	Simple recuperation, combined with recuperation of carbon.	Secondary air heated and portion of carbon in "waste gases" recuperated.	75	17	1·04

The majority of the recuperative settings constructed in this country belong to Class I.; while on the Continent, those possessing the characteristics of Class II. are much more common. A considerable increase of economy is claimed for the latter class, as evidenced by the comparative data given in the table, which has been calculated from particulars supplied by a leading Continental constructor.

The practical application of the recuperation of carbon is at present only in the embryo stage; but those who have made trials of the system under working conditions claim to have achieved complete success. There is no advantage whatever, from a theoretical point of view, in the recuperation of carbon from the carbonic acid in the "waste gases;" but it has been found in practice that the redistributive effect on the several heat zones is conducive to economy in working. The success of the system depends on the well-known principle that the value of any particular method of "setting" or working hangs more upon the excess of flue temperature over that in the retorts, rather than upon the total quantity of heat available; and also partly to reduced chimney losses. The method of its application to retort heating is illustrated by figs. 7 and 8 (next page). About 20 per cent. of the "waste gases" are returned under the producer, and passed through the incandescent fuel, the result of which is the reduction of the bulk of the carbonic acid to carbonic oxide. This absorbs a considerable amount of heat in the producer; but, on the other hand, the gases are drawn in hot, and contain heat about equal to that lost by absorption. The use of steam is absolutely essential; otherwise a very high temperature is engendered above the grate bars.

The system has been applied by Mr. W. J. Jenkins, of Retford, and others; but, as far as the author is aware,

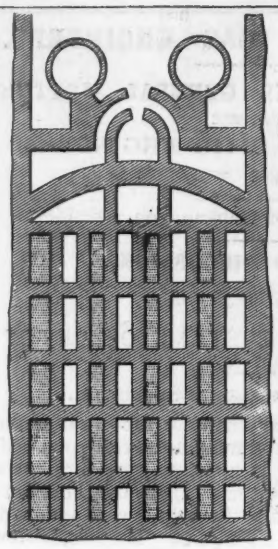


FIG. 1.

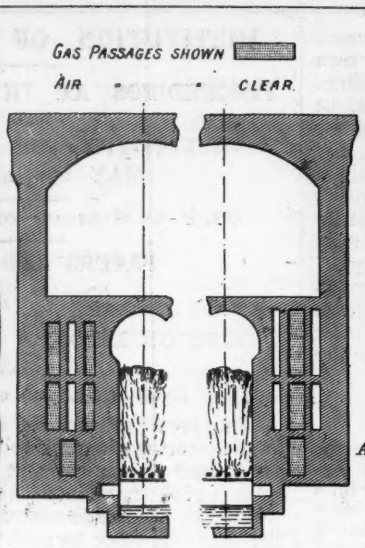


FIG. 2. FIG. 3.

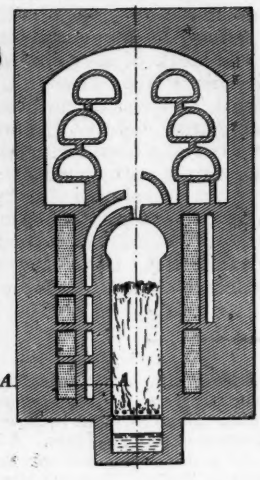


FIG. 4.

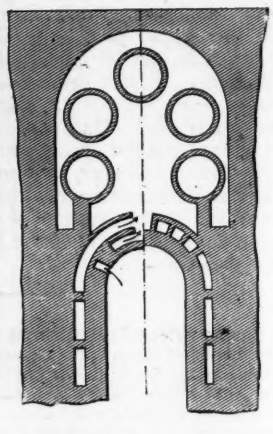


FIG. 5. FIG. 6.

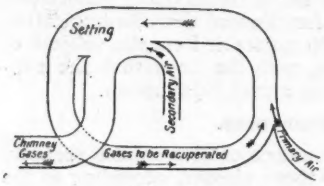


FIG. 7.

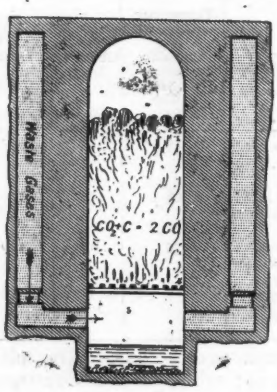


FIG. 8.

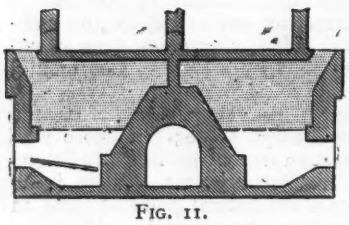


FIG. 11.

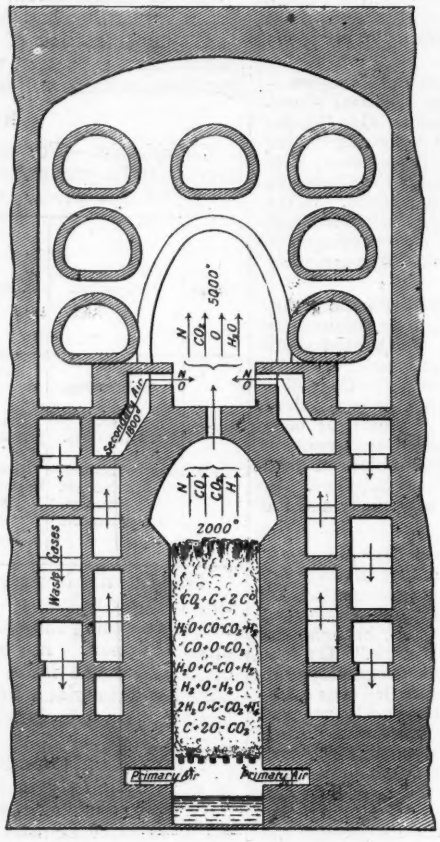


FIG. 9.

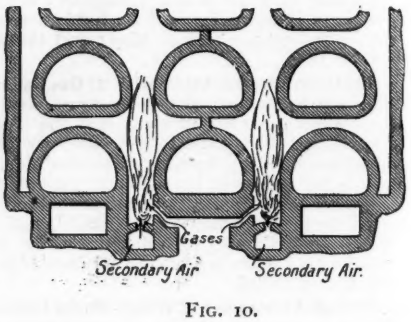


FIG. 10.

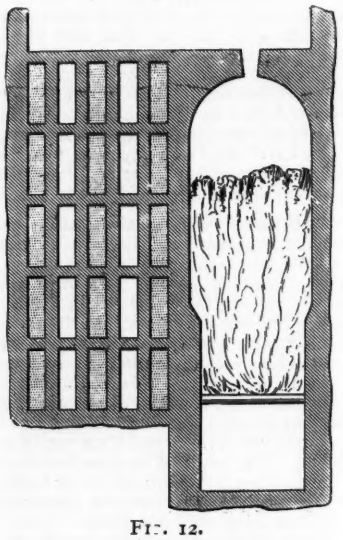


FIG. 12.

it has been limited to combination with "simple" recuperation, though the data available appear to indicate the possibility of greater economy by heating the primary air supply also. The success that has hitherto attended the several trials appears to warrant experiments, on a more extended scale, at the hands of those in a position to make them.

It must be borne in mind, however, that, although settings constructed on the systems classed II. and III. show considerable economy in fuel account, they are not necessarily the most economical from a universal point of view. With "double" and "carbon" recuperation, considerable extra expense and complication is involved in construction, together with a necessity for greater care in working.

Efficiency.—The arrangements of flues in use at the present time for the purposes of recuperation are many and varied; some possessing great merits, by reason of their combination of simplicity of construction with a high degree of efficiency, while others exhibit a total lack of knowledge (on the part of the designer) of the essence of the recuperative principle.

The efficiency of recuperators is not only materially influenced by the character and extent of the passages for the transmission of heat to the incoming air supplies, but also by their location in regard to the producers. In fact, in certain forms, the degree of "true" recuperative efficiency attainable is entirely governed by the situation of the flues in relation to the sides of the generator.

Influence of Location.—The estimation of the real influence of location on the true recuperative efficiency, is a somewhat difficult and tedious operation, involving the classification of a mass of data based on observed results. These data should not be confined to figures deduced from any one particular form of recuperator, but ought to be fairly representative of that obtained from all the various types and systems in use, and, in addition, take account of the varying thicknesses of the division walls between the gas and air flues. The author has therefore compiled the following table, with the hope that it may be of service, not only as an illustration of the importance of giving due consideration to the question, but also as a handy form of reference for those who may be desirous of estimating the degree of

economy likely to be attained by the use of any particular arrangement of recuperative flues. This table has been calculated from figures chiefly obtained from French and German sources, and is approximately correct under average conditions.

*The Influence of Location on the Efficiency of Recuperators.**

Type.	Situation of Producer.	Characteristics.	Fig. No.	Percentage of True Recuperative Efficiency as Compared with Unit Type.	Percentage of Total Heat in Secondary Air abstracted from Producer and Setting.
1	Outside bench	Numerous passages for gases and air supply, with thin division walls.	1	100	..
2	Inside bench	Air flue sandwiched between gas flues.	2	90–95	5–10
3	"	Waste gas flue between air supplies.	3	80–90	10–20
4	"	Air flue between side of producer and waste gas flue.	4	60–80	20–40
5	"	Waste gas flue sandwiched between side of producer and air flue.	5	75–85	15–25
6	"	Air flue by side of producer.	6	6	9½

* The minimum values of efficiency given are for settings of retorts 10 feet long; also for beds of 20 feet "throughs," with producers on each side. The maximum values may be taken for 20 feet "throughs," with producers on one side only.

Some of the figures given in the table may at first sight appear to be rather strained; but a reference to the conditions illustrated on the accompanying diagrams will tend to substantiate their correctness. Taking the type delineated on fig. 4 by way of an example, it will be observed that in this case the air flue is sandwiched between the side of the producer and the waste-gas flue; and it proceeds on the assumption that the temperature in the respective flues at the level AA is as follows: Waste gases, 800°; secondary air, 200°; producer, 3000° and upwards. From this it will be seen that the excess of temperature in the producer over that in the air flue is 2800° Fahr., while that of the waste gases is only 600° Fahr., or less than one-fourth of the former. Supposing also that the thickness of the producer wall is equal to that of the division tile between the gas and air flues, then the amount of heat abstracted from the producer would be at least four times that from the waste gases in the particular line of flue in question. In practice, however, the thickness of the generator walls is at the very least one-and-a-half, and in general four times that of the flue division tiles; while the area of contact between the producer and recuperator only occupies a portion of the surface of the latter. The temperatures in the upper portions also practically balance one another; and, taken as a whole, more heat is found to be abstracted from the waste gases than from the producer, in this particular type of recuperator.

The lowest type, from the "true recuperative" point of view, is that illustrated by fig. 6, which abstracts the whole of the heat imparted to the secondary air from the producer and body of the setting. It has no real recuperative action whatever, and owes the small figure of percentage efficiency given in the table to slight reduction in losses, due to radiation from the producer. Some engineers advocate the abstraction of heat from the producer in this way, with the idea of moderating the temperatures therein, and adduce arguments in favour of such a course; but at the same time they very properly disclaim any attempt at recuperation. In a particular case brought under the author's observation, the whole quantity of heat in the secondary air at the summit of a similar recuperator was credited as economy due to "regeneration," which was, of course, quite incorrect. The mere fact of air being "heated up" is not of itself any proof whatever of recuperation, but it is nevertheless a fruitful source of error in the estimation of economy.

The use of steam under the producers introduces a very disturbing factor in attempts to calculate the efficiency of any particular form of recuperator, as the work thrown upon them is much increased, on account of the additional quantity of secondary air required to be passed through, and proper allowance must be made for this, if even approximately correct data only are required.

Area of Recuperative Surface.—Reliable figures in regard to the extent and character of recuperative surface necessary for the transmission of a certain quantity of heat, at specified differences of temperature, are very difficult to obtain, owing to the disturbing influences mentioned in the preceding section. The author, however, has been fortunate enough to be furnished with the particulars of the working of two forms of recuperators, hereafter referred to by the letters A and B respectively.

Recuperator A was formed of specially moulded blocks, with passages for air and gases passing through them; while B consisted of channels formed of plain division tiles, about 2 inches thick. The results of the two trials are given below, and are most useful in proving that efficient recuperation may be attained by very simple means, and that recuperator A contained at least double the surface necessary for abstracting heat from the waste gases:—

	A.	B.
Area of recuperative surface in square feet per pound of coke consumed in generator per hour	5	2·62
Difference between the mean temperatures of air and gases	752° F.	620° F.
Heat-units given up per square foot per hour	464	840
Heat-units given up per square foot for each degree of difference in mean temperature	0·61	1·35

The main element of success in modern systems of carbonizing lies in the practical construction of the setting. This phase of the subject has already been fully dealt with on previous occasions, and therefore it is not considered advisable to lengthen this communication by entering into details under this head, other than to express a preference for the simplest styles of construction, such as that indicated on figs. 2 and 3. Settings on either of the two systems shown can be constructed at a low capital cost, and are very efficient as recuperators. They also lend themselves excellently well to arrangements of flues which are readily accessible for cleaning and repair.

Use of Steam in Producer Furnaces.*

The advisability of admitting steam under producers is also open to dispute; and, in general, it is much more sparingly used in generators for retort heating than in similar furnaces employed for metallurgical and manufacturing purposes.

The author, having recently had occasion to investigate the question, made a series of inquiries in several directions, with the view of ascertaining the quantity of water vapour passed through the fuel by various engineers; but as the external suply is usually obtained from a boiler or boilers generating steam for the whole purposes of the works, the exact weight admitted to the furnaces was not generally readily ascertainable in every instance. Fortunately, however, in a few cases special methods were employed for producing steam and measuring the quantity of water evaporated; and consequently the data so obtained could not fail to be reliable. The several figures, when first contrasted, appeared to be incompatible one with the other; but a closer investigation dispelled this view, and indicated the factors governing success, under the conditions prevailing in each individual case.

Action of Steam.—The introduction of steam tends in all cases to reduce the temperatures of producers, but not necessarily the formation of clinker. In proof of this, it may be mentioned that in one particular case in practice (worked on a simple recuperative system) the injection of 20 per cent. of steam raised the zone of maximum temperature about a foot higher in the furnace, and created about 12 inches above the grate-bars an arch of clinker which was much more troublesome than if formed in the ordinary way. On increasing the proportion employed to about 33 per cent., it was observed that the zone of maximum temperature was raised still higher, but reduced in intensity, and was then below that necessary for the fusion of the components of clinker. It was also discovered that reducing the whole supply of steam to well below the figure of 20 per cent. quoted, had a beneficial effect in preventing the formation of an arch of clinker, but did not get rid of the trouble of clinkering altogether, as was the case with the admission of 33 per cent. The results obtained in the particular case under review, therefore, appear to point to the inadvisability of following a

* In the case of producers with wet ashpans, the quantities of steam mentioned include that produced by evaporation from the water in the pan, in addition to the external supply.

medium course, and indicate the importance of avoiding the use of certain proportions. The question of the best percentages to employ is rather a difficult one, under the varying conditions of working, and will be the more readily appreciated when it is stated that the data in the author's possession range from 20 lbs. to 77 lbs. of steam per 100 lbs. of coke consumed in generators. and that these widely diverging figures were appropriate to the circumstances in which they were severally employed. With cold primary air, it seems to be advisable to either limit the steam supply to (say) 10 per cent., or increase it to at least 30 per cent. If the primary air is heated, the steam supply must be increased in proportion, approximately as given below:—

	Per Cent. Steam.
Primary air, cold	33
" heated to 400° Fahr.	44
" " 800° "	60
" " 1100° "	72

Chemical and Thermal Changes.—The reactions which take place in a producer worked without steam are well known to be exceedingly simple in character. But this is not by any means the case when steam is admitted, as then not only is there an increased variety of primary combinations, but, in addition, further complex interactions are also produced; and again the balance of changes so produced is practically reversible, according to the influence of varying temperatures and quantities of water vapour injected.

As an illustration of the possibility of such reversals being brought about under the conditions existing in generators, reference need only be made to variations in the reactions between incandescent carbon and water vapour. At temperatures of 1800° Fahr. and upwards, the reaction between carbon and water vapour is practically $C+H_2O=CO+H_2$; but should the intensity fall below the limit given above, and undecomposed steam be also present in excess, carbonic acid is produced, in accordance with the following equations:—

$$C+2H_2O=CO+H_2O+H_2=CO_2+H_4,$$

in increasing proportions as the temperature is reduced.

Other important chemical changes are also illustrated in fig. 9.

There is also a considerable difference in the respective depths at which carbonic acid commences to be reduced, between generators worked with and without steam. In the former class, cases are known in which the carbonic acid has not been reduced at a height of 3 feet above the grate bars; while in the latter, a large percentage of carbonic oxide has been found in some cases at 12 inches up in the producer. It is therefore very necessary to have a deep fuel bed where steam is generously used.

The chemical efficiency of generators is slightly reduced by the use of cold coke, which, as is well known, contains a considerable quantity of water. When the coke is thrown in upon the top of the incandescent fuel, the moisture present in it is driven off into the crown of the furnace, as undecomposed water vapour, which reacts upon the carbonic oxide in the producer gases, in accordance with the following equation:—

$$CO + H_2O = CO_2 + H_2,$$

and may also possibly vitiate any analyses of the gases which might be taken near the time of charging.

The dissociation of steam in passing through the incandescent fuel in the producer absorbs, or renders latent, a large quantity of heat, and therefore exercises a most beneficial action in moderating any excessive temperatures. It is almost needless to add that the exact quantity of heat absorbed in decomposing water in the producer is reproduced by combustion in the setting. The temperatures available for heating the retorts should therefore be theoretically constant, whether steam is employed or otherwise. It has, however, been found in practice that the combustion of the hydrogen (produced by dissociation of water vapour) is much quicker than that of carbonic oxide, and therefore produces a zone of relatively higher intensity, within certain distances of the gas and air nostrils.

It must be borne in mind, however, that a portion of the heat produced by the combustion of hydrogen is rendered latent, and must be discarded in calculations bearing upon the total quantity of caloric available for carbonizing; the total quantity of sensible heat units yielded per pound of hydrogen consumed being only 52,000, as against 61,500 when the resulting gases are cooled down to such an extent that water vapour is condensed to the liquid form.

Construction of Settings.—Success in the use of steam is also partly dependent upon the construction of the settings. If steam is largely employed where the combustion space is constricted, as shown on fig. 10, much trouble is caused by the fusion of the retorts and division walls, owing to the very high local temperatures engendered. The best remedy for the latter trouble seems to be in the use of a roomy combustion space, so that the full energy of the combustion may be utilized without any drawbacks. The provision of such a space, as opposed to that of an enclosed combustion chamber (irrespective of the use of steam or otherwise), has proved in practice to possess great and undeniable advantages, not only in the mitigation of cutting heats on the retorts, but also in the facility it gives for access to every part of the interior of the setting for purposes of repairs.

Variations in Air Supply.—The respective quantities of primary and secondary air required are governed by the quantity of steam injected; the former being decreased *pro ratâ* with the weight of water vapour admitted, while the latter is correspondingly increased—the total combined weight being theoretically constant.

The admission of steam, therefore, incidentally affects the work thrown upon the recuperators, as illustrated by the following table, calculated under three suppositional conditions:—

	Without Steam.		33 per Cent. Steam.		77 per Cent. Steam.
Primary air per pound of coke consumed.	5·5	..	3·5	..	2·56
Secondary " " .	4·5	..	6·5	..	7·44
	10·0	..	10·0	..	10·0
Relative work thrown on recuperators. .	1·0	..	1·44	..	1·64

The author ventures to think that, on the whole, the generous use of steam is an advantage, principally on account of the possibility of the reduction of some of the arduous work of clinkering. This statement, however, only extends to its use in settings, where the combustion space is ample.

Analyzing Waste Gases.—The methods in general use for analyzing waste gases are subject to considerable error when applied to gases containing a large percentage of water vapour, such as is produced by the free use of steam under the producers. This water vapour, in most cases, is partly condensed out before the gases enter the burettes; and the results obtained represent the composition of the residual gases after the moisture is eliminated. Under ordinary circumstances, there is no practical disadvantage in this; but it is desirable, in experiments involving the generous use of steam, that the real percentages of water vapour present should be ascertained correctly.

It has occurred to the author on several occasions that it would be of some advantage to have a means of ascertaining the approximate composition of the waste gases by mere inspection. He therefore ventures to suggest the use of a modified arrangement of the Lux specific gravity balance; the scale being graduated to show percentages of carbonic acid, in lieu of specific gravity, as in the ordinary form of the instrument.

Appendix.

Formulæ for Generator Settings.

F = Weight of coke put into generator in pounds.

P^H = " primary air for producer fed with hot coke . . . = $5{\cdot}3$ to $5{\cdot}8\,F - 3{\cdot}81\phi$

P^C = " do. do. cold coke . = $5{\cdot}0$ to $5{\cdot}5\,F - 3{\cdot}81\phi$

S^H = " secondary air — hot coke = $10{\cdot}0\,F - P^H$

S^C = " " " cold coke = $9{\cdot}6\,F - P^C$

VP^H = Volume of primary air—hot coke = $13{\cdot}14\ P^H$

VP^C = " " " " cold coke = $13{\cdot}14\ P^C$

VS^H = " secondary air — hot coke = $13{\cdot}14\ S^H$

VS^C = " " " " cold coke = $13{\cdot}14\ S^C$

V = " of air = $13{\cdot}14$ cubic feet per lb. at 62° Fahr.

ϕ = Weight of water or steam injected into producer in pounds.

G^P = " producer gases = $0{\cdot}83\,F + \phi +$ (P^C or P^H).

T' = Temperature of gases leaving producer $= 2800° - \frac{2700\phi}{F}$

G^{PV} = volume of producer gases

$$80\ F \frac{\left(2800° - \frac{2700\phi}{F}\right) + 461}{523}$$

or at temperature T'—

$$= 80\ F \frac{T' + 461}{523}$$

or at temperature 2000° = 367 F.

G^{s} = weight of "waste gases" from setting

$= 0{\cdot}83\ F + (P^{H} \text{ or } P^{C}) + (S^{H} \text{ or } S^{C}) + \phi$

G^{SV} = volume of "waste gases" from setting at temperature T''

$$= 145\ F \frac{T'' + 461}{523}$$

or at temperature of 2000° Fahr. = 491 F.

N = area of producer nostrils

$$= 80\ F \frac{\left(2800° - \frac{2700\phi}{F}\right) + 461}{150{,}000}$$

where F = fuel in pounds per hour.

T = theoretical temperature available in setting.

T'' = temperature of gases leaving setting $= 0{\cdot}458\ T$ approximately.

T^{SA} = temperature of secondary air at outlet to recuperator $= 0{\cdot}4\ T$ or $0{\cdot}88\ T''$ approximately.

B.T.U. in waste gases

$= (0{\cdot}83\ F + (P^{C} \text{ or } P^{H}) + (S^{C} \text{ or } S^{H}) + \phi)\ 0{\cdot}458\ T \times 0{\cdot}253$; or

$$\frac{G^{s} \times 0{\cdot}458\ T}{3{\cdot}95}$$

Discussion.

Mr. C. C. CARPENTER (London) thought that papers read before the Institution might be divided into two classes—one class which appealed very much to one set of the members, which brought rapidly before them new ideas; and another kind of paper which it was an advantage to study. He meant nothing disrespectful of Mr. Lewis's paper when he said that it fell within the latter category; but with regard to the particular teaching conveyed, he was not quite sure that he was able to follow it. He rather gathered that it was an analysis and statement of the various actions which took place in a recuperative setting, and the value which might be obtained by the perfection or otherwise with which the different operations were carried on. They must not lose sight of the fact that, to attain this high degree of efficiency, a large expenditure of money was required; and the point to be considered, when they wanted to supply gas at the lowest figure, was whether the advantages justified the outlay. Diagram No. 1 illustrated this point very clearly. He did not gather from the author whether he held this up as an ideal setting in the retort-house, and whether it was one he would recommend; but he was afraid he should be compelled to say that the advantages to be derived from the extent to which he had carried out his ideas of recuperation in that case would not be paid for by the money returned in extra coke sold. With schemes of recuperation, there were, in his opinion, two drawbacks always present, one of which was the large scale to which gas-making operations in retorts were now extending. A delicate piece of machinery such as the recuperator, required a great deal of attention to maintain the proper balance of heating effect in the setting. Some time ago, in discussing this matter with a leading gas engineer, he said that with respect to his particular modification he was not happy unless he saw his settings three times a day. Now on a large scale it was not possible to carry on economically a plant which required such frequent inspection of the setting by the engineer. Another point was with regard to the wear and tear. With retort-settings in which the recuperation was of a far less extensive character than this, it was possible to regulate and control the heats with a great degree of accuracy; and any difficulty with regard to the local heating was not apparent. With a system of gaseous firing, the average life of retorts had been 2400 working days. This was a long life; but it was attained without any special attention in the ordinary routine of a large gas-works—none of the retorts being repaired in that time beyond stopping cracks. The cost of retort-setting appeared to be increasing at a greater ratio than any other portion of their labour—at any rate, in London. There was very considerable difficulty in getting retort-setters and bricklayers who could do fire-work; they demanded a higher scale of pay than other mechanics, and it was very important that plants should be put in as economically as possible, so as to obtain the longest duty from them. He noticed that another diagram (fig. 10) showed a setting of nines, which was a very popular one with many engineers. He gathered that Mr. Lewis was not quite in favour of it; and if so he should strongly support him in his opposition to the arrangement. It was one thing to pack the greatest number of retorts possible into a setting, and another to regulate the heats, and obtain the greatest duty from the retorts during their life, and the greatest uniformity of heating. Certainly, two retorts sandwiched between two zones of combustion, and two outside which had the zone of combustion on one side and to some extent the waste gases going away on the other, must result in the heating of the retorts being very unequal. Some attempt had been made to overcome the difficulty by shielding; but he thought it a very imperfect way of regulating the heat of a retort to make part of it twice as thick as it ought to be. They had been trying for some eighteen months a thin retort—about 2 inches thick—and though this was part of a range, and it was not possible to heat it by one furnace, or to measure the amount of gas it took, yet it was worked for thirty or forty days with less fuel than the setting on the other side under identical circumstances, except that the retorts were about 50 per cent. thicker. This pointed to the desirability of getting the retorts as thin as possible, consistent with maintaining their shape throughout the work. Another diagram (fig. 11) showed two producers; and he understood this was put forward as the best arrangement of producer for heating an ordinary setting. He did not think it was the best arrangement, because, in the first place, the power of the producer was so great that it would not be necessary to have two. Certainly arrangements were required for distributing the gas from the producer, and for making the supply uniform; but it was not necessary to have two. Mr. Lewis also spoke of the advantages of the addition of coal fuel in charging the producer. But this depended to a considerable extent upon the arrangement of the producer; and that was one reason why he thought the system of making the producer part and parcel of the retort-setting was not the right one. The method of converting coke into heating gas should, in his opinion, stand by itself. The producer should be designed as an efficient instrument for converting coke into fuel gas; and its design and arrangement should not be bounded by the exigencies of the space between the walls of a setting. The last producer he had put in at one of the South Metropolitan stations was 19 ft. 6 in. high. The upper part of the producer was arranged as a hopper for cold fuel; and one-third of the distance down there was an outlet-pipe which went from one side of the producer to the other, carrying off the gas to the retort-setting. The advantage of this was that a uniform level of fuel was always maintained in the producer. There was always a layer of fuel above the outlet of the gas, which prevented any air being drawn in when the lid of the producer was opened for cleaning. They found, by analysis of the gas, that the chemical composition was uniform within the limits of the simple tests they used throughout their daily work. The gas was led direct from the producers to the settings in the same way as they would do if the gas were obtained from another source altogether; and his view was that this, and this only, was the system of heating retorts from which the greatest advantages would be found.

Mr. WILLIAM FOULIS (Glasgow) asked the diameter of the producer.

Mr. CARPENTER said it was about 9 feet by 12 feet. It was a rectangle.

Mr. G. HELPS (Nuneaton) asked Mr. Lewis whether, when he spoke of the relative values of these recuperators, the settings were all of similar construction to those he set out in his first table. His experience with regenerators of all kinds had been that nearly always the flues or passages for the gases were not sound; and it was quite possible that the soundness of the flues might have varied in the different instances. Again, he should like to know if the producers were connected with similar settings, because his experience had been that different settings had

a very material influence on the amount of fuel used. It appeared from the table that double recuperation was better than simple; and he also held this opinion until a few months ago, when he fixed up a setting which had about six tiers of flues in passages—three for secondary air and three for primary, but so arranged that they might be changed. The setting that was mainly heated by primary air reached a temperature of 1500°; and it was a very clean arrangement. Then he closed this portion of the recuperator off, and admitted the cold primary air. The retorts were charged every four hours with 3 cwt. of coal. They were very gradual heats; and he failed to discover any difference in the fuel consumption with the heated primary air.

Mr. G. E. Stevenson (Manchester) said he had been much interested in this subject from the time it came up; and he had been greatly struck with one thing about it—namely, that there seemed to be two distinct lines of opinion upon the matter. There were some who thought that gaseous firing in itself was the great source of economy, and that when once one had gaseous fuel everything had been done that was worth doing. There were others who thought that the application of the recuperative principle—the extraction of the heat from the waste gases, and the utilization of this heat again by communicating it to the air supply—was of equal importance. He must say he belonged to the latter class. He quite appreciated the value of gaseous firing; but beyond that he believed in thorough recuperation also, by which he meant the abstraction of as much as possible of the heat contained in the waste gases, and its re-introduction into the setting. He did not think it very much mattered, as far as the question of economy of fuel was concerned, what proportion of this heat was introduced through the secondary or through the primary air; but it was very easy to go to excess in heating the primary air. When he heard of 1100° to 1500° being applied to the primary air, he wanted to know what fire-bars would stand this heat. What would be the condition of the grate after a day's working? It was quite true that the waste gases contained practically double the volume of heat one could put into one of the two—a great deal more heat than could be put into the secondary air supply, and what could not be put into the secondary air one might as well endeavour to utilize in heating the primary air. Most people who had gone into this process had endeavoured to first heat the secondary air to such a point as was practicable, and then utilize the waste heat for the primary air; and by this means a high efficiency was obtained. When the waste gases were down to such a temperature that the main flue showed no colour—was practically black—one had not done very badly; and, in fact, one could do no more. There must be sufficient heat in the waste gases to create a draught. With a setting built for inclined retorts the draught had to be sufficient to pull the gases up 20 feet high, and then down again 20 feet; and this required a considerable difference in temperature. All these discussions on furnaces and regenerative heating were very useful, because there was always something fresh elucidated. For instance, the question which Mr. Lewis had brought forward about turning on steam under the fire-grates, was very useful. He did not employ steam himself. He used water trickling over plates, which he thought was quite sufficient; but he knew there were others who found steam useful. By its use, the zone of intensest combustion was transferred further up into the furnace; and according as the setting was constructed with this object in view or otherwise, a useful advantage was gained. He preferred to have a pretty intense temperature in the lower zone. He believed one did not get the carbonic acid reduced properly and fully to carbonic oxide, unless there was a fairly high temperature in the lower part of the producer.

Mr. T. Holgate (Halifax) asked, with reference to the statement in the table with regard to Class III., "Secondary air heated and portion of carbon in waste gases recuperated," what proportion of this gas was supposed to be treated there. Was the statement based on the estimate that 50 per cent. of the waste gases were employed, or on some other figure? It would be in the recollection of many members that a few years ago Mr. Head, who represented Messrs. Siemens, brought to the notice of gas engineers a method of utilizing waste gases by passing 50 per cent. underneath the grate of the producer, with a view to reducing the carbonic acid to carbon monoxide—a method which had been followed out in connection with steel-heating furnaces with good results, as was claimed. Having occasion to reconstruct some settings with regenerative furnaces, he placed them at the disposal of Mr. Head, to see what could be done by the utilization of the waste gases. The recuperative flues were so arranged that the settings could be worked in the ordinary fashion, or a portion of the waste gases could be put under the grate. But there a difficulty arose. Theoretically, 50 per cent. was required, and the quantity sent under the grate had to be regulated by a steam-jet, which was very erratic. The quantity sent in would vary with the steam pressure, and the temperature of the waste gases, after passing through the whole length of the recuperator, was not sufficiently high to become of use. The conditions were very different to those which existed in the case of the steel-heating furnace. In that case the waste gases came at a very high temperature straight into the furnace; and those conditions sufficiently explained why Mr. Head was not able to make his trial a success. Theoretically, it would be an advantage if some portion of the waste gases could be taken, before being cooled in the recuperator, and passed under the grate; but then came the question whether, after all, this was the best method, even theoretically. An idea had been passing through his mind which might perhaps have been put to the proof by some of the members; and if so he should like to hear the result. In days gone by, Mr. Croll, at the Great Central Company's works, arranged to have underneath the ordinary clay retorts a number of iron retorts, where the heat from the clay retorts could be utilized. To this extent these iron retorts were recuperators. Now they had gaseous fuel, it occurred to him that it might be possible to have a large producer as Mr. Carpenter suggested, and introduce the whole of the gas made in it into the first setting—admitting into the setting just the necessary amount of air to cause the combustion of a part of the producer gas sufficient to give heat in the setting—then pass the whole of the waste gas from the setting into the next, and admit another supply of air, and so on, in succession; allowing in each successive setting the amount of air required to raise the temperature of the gases to the carbonizing temperature. The retorts would then really be made into recuperators; simply raising step by step the temperature of the gases by the admission of the proper quantity of air as the process proceeded. After a certain limit had been reached, the waste gases could be passed through an ordinary recuperator, and in this way supply the settings with heated air.

Mr. Foulis said this was a very old subject with him, for he was about the first to introduce these settings into this country. There was one remark in the paper he did not clearly understand, and that was about the temperatures. Mr. Lewis said the excess of temperature in the producer over that in the air-flue was 2800°, while the waste gases were only 600°, or less than one-fourth of the former. He did not exactly understand to what this referred. There were two other matters he should like to mention. The first was with reference to equally heating the retort-settings. The great point to pay attention to was that the air and gases were brought together in such a way that one had no blow-pipe flames, but a gradual consumption throughout the setting. The consumption should be as regular as possible throughout the whole setting. If this were done, there would be no difficulty in any sized setting in having equal heats. He quite agreed with what Mr. Carpenter had said, that the method of heating the retorts in the future would be by having large producers altogether separate from, and outside, the retort-house, where gas, not only for heating retorts, but for all other purposes of heating in the works, would be produced and carried by flues to the various points where it was required. He had been experimenting in this direction; and during last winter they had sixteen settings of twelve retorts each heated in this way, with a very considerable amount of success. The experiment was not quite so satisfactory as he should have liked; but they were now carrying out certain alterations, which he thought would make it perfect. He was quite sure this was the method which would be adopted in the near future, at all events in large gas-works.

Mr. P. H. Fletcher (Evesham) asked why steam had the effect of causing a cutting action in the setting. It seemed to him that when one had a gas-fired setting, no cutting action could take place. There should not be any

draught in the setting at that time. Fig. 10 also did not appear to represent what was actually taking place in a setting of the kind. He did not see why they should expect to get a more even heat in such a setting. There would be more heat in the middle of the retorts than on the outside, which there would equally be in fig. 4 or 5. He thought the amount of heat in between would greatly depend on the draught. If the gas were pulled through the setting, it had a tendency to make a blow-pipe flame; but if there was no more draught than necessary, which would really produce a pressure in the setting, the most economical mode of working would be found with a very heavy pressure, or with a pressure very low down. In this case, the point of flame would be like a blow-pipe, because it could be extended right down into the waste-gas flue, where recuperation was going on. It showed the flame was not a short flame. As air was added and the pressure increased, the flame was shortened. He did not think, if the setting were worked with sufficient draught, but not too much, fig. 10 would be far behind fig. 4. As far as an outside producer went, there might be many advantages. But though it might be more scientific, the question of cost of erection would come in. He thought it would be much more costly than an ordinary setting with a producer underneath; and he did not believe the fuel account would be any better.

Mr. E. A. Harman (Huddersfield) said he should like to ask Mr. Lewis what special views he had in his mind in framing the first paragraph of his paper.

Mr. T. S. Lacey (London) said, with regard to the blow-pipe flame, it might be of interest to state that he had a case in which he got a setting of retorts rapidly destroyed by being heated up by a flame of this character. There was a large excess of secondary air, which produced a very intense local heating, and destroyed the setting. If the air were in excess, it always meant carbonic oxide in the furnace; and there was therefore great danger in having a very large excess of secondary air producing this kind of flame. This must be guarded against, or it would completely destroy the setting in a short time.

The President said he must confess he did not quite see the drift of Mr. Lewis's paper. He appeared to be a special pleader for the use of steam under retort-settings. It seemed to him that to use steam under settings was unnecessary, because it was possible, in a properly arranged regenerator setting, to always have sufficient waste-gases come in to create steam in the last passage; and if a cast-iron box were put in that passage, there would always be sufficient waste heat to create all the steam wanted to keep the fire clear of clinkers. Beyond this, he did not see that the use of steam played any important part in the setting itself. Many people on the Continent had tried steam injection; but they had all given it up. They had ten gas-works, and ten managers; and they had all tried different experiments, but came to the conclusion that steam was of no great use. When they first tested this system, they admitted the secondary air and cooled the furnace gases so low that they could not get sufficient heat under the fires; and then they had recourse to steam for a short time. But when they rebuilt the settings, they took care to make the flues so as to get sufficient heat underneath the last channel, where there was a water-box. At Brentford, some years ago, when he started a regenerator setting there—a Klönne setting, which was the first put up in England—it was found absolutely unnecessary to use steam. All that was needed, in order to keep the fires clear, was to have the zone of combustion at the proper place in the regenerator. With regard to heating up the primary air, they tried this too, but had given it up. They made many experiments, but found no results worth obtaining by heating the primary air, because it had to be heated up at the expense of something; and it was far better, if one wished to heat air at all, to heat secondary air in the natural way through the setting. He therefore believed it was waste of money and time to endeavour to heat up the primary air; and this view was borne out by what Mr. Holgate had said. Those who read the "Journal of Gas Lighting," might have noticed a passage of arms between himself and Mr. Carpenter some time ago on this subject. Mr. Carpenter thought that the generator should be outside the setting; while he (Mr. Marshall) had a firm belief that it should be inside. His reason for the belief was that it would store the radiated heat. The reason for Mr. Carpenter's view was perfectly correct, and he thoroughly appreciated it—that they should always have a super-incumbent weight of fuel over the exit of the gas. Speaking with his Manager the other day, they came to the conclusion that if they built more settings they would sacrifice the principle of saving the heat in order to gain what Mr. Carpenter wished to gain by taking the gases away from a lower zone in the generator. He did not give in to Mr. Carpenter entirely, because he did not believe they were going to have one generator and take the gases away to any portion of the retort-house; but he did agree with him that one must take the gases from the generator at a level where one did not, on opening the generator, get a cold blast of air into the setting. It did not matter how nicely the flues were adjusted, or what appliances there were for controlling the secondary or primary air inlet, if one was continually taking off the top and filling it up with cold fuel one was upsetting the equilibrium of the retort-bench for two hours afterwards. They took enormous pains, and had a chemist continually analyzing the furnace gases or the waste gases in the main flue; and it was impossible to properly control the secondary or primary air unless this was done. The amount of air drawn up the main shaft varied every hour in the day—it was never constant; and the result was to alter the equilibrium of the furnace. Therefore, to arrive at perfection, there must be an automatic regulator inside the flues, to be balanced by the force of the wind. This was the theoretical idea. They tried to meet the difficulty by having on the inlet of the primary air a suspended flap—it was a German invention—so that as the draught in the chimney increased, this automatic flap was closed to a certain extent, in order to allow what they believed to be the theoretical amount of primary air to enter. They did not care much about the secondary air, because a little more or less did not play any very great part in the economy of the setting; but the primary air had to be apportioned absolutely to the chemical requirements of the generator. The secondary air to some extent took care of itself; but if it was desired to get thorough results from a setting, the primary air must be studied. Many people, instead of letting it go under the bars direct, made it take a sinuous course through the side of the setting, and then underneath the bars. This was a good idea, because the sinuous passage was not subject to blasts of cold air through the retort-house which were experienced when the primary air was admitted immediately under the bars of the furnace. They had now furnaces in which they had brought the consumption of coke down to from 10 to 12 lbs. per 100 lbs. of coal carbonized. There were two gentlemen present, who were the Managers of the Fredericksburg and Flensburg works, who would be pleased to show the accounts they returned to him at the end of every half year. The accounts of the Manager of the Flensburg works were at present the best; showing 10 lbs. of coke per 100 lbs. of coal carbonized. Another matter was the cost of brick-laying, which Mr. Carpenter had touched upon. In a paper he read there two years ago, he pointed out that abroad they never used bricks, but only what they called block stones or moulded blocks. These were carefully made and numbered; and if he were furnished with a diagram of the setting, it was very easy for even an inexperienced man, only decently clever with his fingers, to put a setting together. In using brickwork, if a brick did not quite fit there was a tendency to jam it up with little wedges, and so on, and sometimes to leave very large joints of mortar. Theoretically, of course, there were no large joints. Retort-setters, however, were but human; and after the work was finished these large joints soon burnt away or settled, and if there was the slightest settlement, it was the first step towards a crumbling up of the whole setting. When he first went abroad, he pooh-poohed the idea of block stones, and had an insular prejudice that bricks were the only proper things to use; but he had not been abroad more than three years before he came to the conclusion that his predecessors there were quite right in adopting blocks for settings. If it was correct in a horizontal setting, much more so was it with an inclined setting. With a 20-foot inclined retort on brick piers, the slightest wobbling that took place might upset the whole alignment. He had a tracing on the table of what was believed to be a typical setting of a Continental inclined retort; and there was hardly a brick in it. It was entirely built with block stones. It would give him the greatest pleasure

if some of them, next time they set a retort, would try this block-stone system. It needed very little mortar; and if the stones were put together with sufficient room for expansion when the setting heated, they would last very well. Of course, when a block-stone setting was broken down there was a lot of waste stuff which was of no use; whereas in a brick setting one could chip up a brick, and make it useful again somewhere. Still, there was danger in a retort-setting that, if any brick were not absolutely square, it was not fit to be used; and therefore with blocks it was better to break them up, and get rid of them. Lastly he should like to ask Mr. Lewis how the temperatures were obtained, and the measurements which must be assumed to be correct; and he should be glad to know how the mean temperatures and the areas were ascertained. In a paper like this, which bound them down to certain facts, they could not accept the facts unless they knew how they were ascertained; and it would be of immense value to him to know how the table referring to diagram No. 10 was obtained—namely, the amount of primary air per pound of coke consumed without steam and with steam—and how he got the primary amount of air consumed and the secondary air, and the relative work thrown on the recuperators. This was such an important statement, that he was sure Mr. Lewis would elucidate what seemed a little obscure in his otherwise excellent paper.

Mr. Lewis, in reply, said he did not pretend that he should advocate the particular settings shown on the diagrams. They were simply put there to illustrate certain principles; and he took No. 1 as a unit, as giving the theoretical complete recuperation. It would be obvious that such a setting would not be successful in practice. It was simply given as a unit type, to show something to base other results upon. The sketch was taken from a German illustration; and he believed it had been actually used. No. 12 was a French setting, somewhat similar, but with the producer on one side and the regenerator on the other. This also would have some advantages; and he gave it as an illustration of different methods. Personally, he thought figs. 2 and 3, taken as a whole, were in most general use, and gave practically better results than No. 1. With regard to No. 11, showing two producers heating the setting, it was merely an illustration to show the large amount of surface exposed on the side next the recuperator, in a setting of this description—not as an example of a good setting. Most people now-a-days had a producer on one side only. He quite agreed with Mr. Carpenter, with reference to setting No. 10, as regards the local heating between the two bottom retorts; and this applied more particularly when steam was used. In this case, the temperature was certainly very high just at the point between the two retorts. With regard to the President's question as to how the results were arrived at, the figures he had given had not been obtained from merely one particular furnace, but he had taken a large number of results and adopted the average—selecting those examples in which there was least disturbing influence. The sources in most instances were from Continental experience; and he had been as careful as he could to only take those examples which he had reason to believe would be fairly accurate. He had taken some fourteen or fifteen, and made an average. With regard to the temperature, that was a very important point, and one which required to be further looked into. It was very difficult indeed to get these temperatures absolutely—for instance, the temperature of the air entering the setting at the point of combustion. In some cases it had been done by taking a circular piece of iron of a specified diameter and length, putting it in the flue, and then taking it out and immersing it in a vessel of cold water so arranged that, by taking the difference of temperature in the water after the metal was fully cooled down, the heat could be calculated. The results obtained in this way were superior almost to any others. He had tried pyrometers of English make himself, but was never able to get any very good results.

The President said it would be interesting if Mr. Lewis could show them a diagram of some setting he had worked himself. Some of those on the wall had very small nostrils for the exit of the gases; and he thought it was wrong to confine the crude gases in the way they were shown. Either they were very old drawings or else there must be something wrong. They knew they would never obtain good results in any of these settings, where they were wire-drawing the products of combustion through such narrow channels.

Mr. Lewis said they were simply diagramatic. No. 2 was the system in use at the Crystal Palace Gas-Works. It certainly was not his intention to plead for the use of steam. He simply gave certain results; but when he said that he believed on the whole the balance lay in favour of the use of steam, he thought the President agreed with him to some extent, because he gathered that he had a special arrangement for passing the waste gases so as to heat up a water-box, which practically amounted to the same thing as using steam. He did not refer specially to a jet of steam from an extraneous source.

PRACTICAL WORKING OF CARBURETTED WATER GAS.

By Charles F. Botley, of Hastings.

The manufacture of water gas affords many opportunities for investigation, and, without doubt, has great possibilities. The few remarks the author has the honour of submitting to-day are the result of his experience at Hastings in the responsible supervision and occasional actual working of a plant. It is desirable to point out that in the year 1895 the matter of enrichment became an important question at Hastings, owing to the price of cannel, &c. At first, as was only natural from previous experience of those concerned, oil-gas manufacture (the Peebles process) was very much favoured. But finally, owing chiefly to the advantages offered by the disposal of surplus coke, the wider range of available oils, the addition to the productive power of the works, and rapid production in emergency, carburetted water gas was adopted; and, in the result, the author feels sure that his senior, Mr. C. E. Botley, M.Inst.C.E., has had every reason to be glad of his decision.

The plant, as originally erected by the Contractors, under the supervision of the author, as the Engineering Assistant of the Company, comprised two sets of generators, carburetters, superheaters, scrubbers, and washers, of a nominal capacity per diem of 375,000 cubic feet each. The other plant consisted of a water condenser, 30,000 cubic feet per hour meter, 30,000 cubic feet relief gasholder in steel tank, separator, two circulating water-pumps, two oil-pumps, one tar-pump, two oil-meters, two high-speed double-cylinder vertical engines, driving the fans by means of belting—each fan and engine being equivalent to the two sets working simultaneously, in view of extensions. There are six oil-tanks, 24 ft. by 9 ft. diameter, of a working storage capacity of 50,000 gallons. This subdivision of storage may appear curious; but it was necessary to meet the circumstances of the position, &c. Above the oil-stores the circulating water-tank is placed, divided into two partitions for boiler feed and for supply to washers, scrubbers, &c.

In conjunction with the water-gas plant, a modern high-pressure steam installation, 110 lbs. per square inch working pressure, was put down, comprising two 24 ft. by 7 ft. Lancashire boilers, consuming either coke, breeze, tar, or other refuse, and fitted with Green's economizer, exhaust steam water-heater, and chimney. Of course, feed-pumps, tar feed-tank, &c., are included; and these boilers supply steam to the whole works. The cost of the plant, as just described, has been about £10,000; existing buildings, altered to suit, being used to accommodate the apparatus. The original plant has been altered and considerably added to, as will be referred to in due course.

It will be convenient to deal with the manufacture in the various stages of the process. Thus, to start with the production or generation. The generator plays a vital part in the manufacture, and is subject to more wear and tear in comparison with other parts of the apparatus. At Hastings the usual fuel bed is 4 ft. 10 in. in diameter by 9 feet deep when making an average of 20,000 cubic feet per hour, as against 15,000 to 16,000 cubic feet, the rated capacity of the sets. In lieu of a better arrangement, the coke at present has to be delivered in barrows to a small space provided near the plant, where the charging-barrows are filled, and then hoisted, by means of a steam lift, to the operating floor. The original lift has been entirely remodelled; but although the working is now satisfactory, the waste of steam is considerable, and when possible a hydraulic lift would be preferable. Some coke (10 tons or

so) is always kept on the stage for emergency. Dry coke is very necessary, or retort carbon can be used. The better the fuel, the better the working. The blowers and engines claim attention with the generators, and should always be started (if the plant has been standing for a short period) before anything else is done—for under some circumstances it is possible for gas to gather in the blast main;* and, as a further precaution, they should not be stopped more than two minutes occasionally for examination during working. When the blowers are stopped, the relief-valves on the blast main can be opened. The proper, or most suitable, amount of blast is of importance. It must be enough, but anything beyond will cause waste of fuel, excessive burning of the generator lining, heavy clinkering, and much coke dust deposited in the neighbourhood. The author finds a blast pressure of 16 to 17 inches of water ample. This will give some 10 or 11 inches under the fire-grate. The speed of the fans or blowers is reduced from about 1700 to 1800 revolutions per minute during the "blowing up" to some 500 or 600 revolutions during gas making. This, of course, saves steam, answers well, and is accomplished by the operator closing, by means of suitable gear, the main supply of steam, and leaving only a bye-pass. The engines being vertical, and of high speed (280 to 300 revolutions per minute), require constant careful attention; and, especially when the speed is varied, precautions must be taken that the condensed water in the cylinders can always escape freely. Likewise, the governor gear must always be kept in good order. These engines drive the fans by belting; and for the high speed required, it is very desirable to have light endless belts. Such will be found in the Balata make; but these must be protected from oil or resin. The original generator fire-grates did not answer, owing to the heat causing them to sink, and in sinking bringing the fire-bars so close together as to block the air-ways. New grates were adopted, having two specially designed cross-bearers instead of one; but even these show signs of sinking. The size of the bars is 3 in. by 2 in. flat, which have proved satisfactory, although a taper section would allow ashes to escape more quickly, and probably a mechanically operated grate would be an advantage.

Careful clinkering is very essential, and is done generally about every five hours, or once for every 100,000 cubic feet of gas made, which has been found to enable remarkable uniformity in make per run to be attained. At each clinkering there is, of course, a considerable amount of material removed from the generator. When working day shifts only, this averages 8½ cwt. per clinkering, and is composed of 2½ cwt. of clinker and 6 cwt. of coke and breeze. The latter are used for boiler fuel, and are not included in the figures given for fuel. Dry high-pressure steam should be available at the generator—100 lbs. per square inch usually, and 90 lbs. as a minimum. A good steam-trap is therefore an advantage on each generator steam-pipe; but, despite these precautions, No. 2 set is at a disadvantage as regards No. 1 in the matter of carbonic acid produced, it being farther from the steam-main. The matter of the amount and distribution of steam in the generator is an interesting one. Other conditions being normal, the make per run will vary tremendously with a given opening of the steam-cock. This is owing to the condition of the fire; but experience soon decides the proper or best quantity. It has, however, been found more satisfactory not to interfere, under ordinary circumstances, with the steam-cock; and many times it has been noted that, when the steam has been on in excess, the valve has been turned back without reducing the make per run, but with a reduction in the amount of carbonic acid. Excess steam means unnecessary expenditure of fuel, and, as a result, makes a lot of clinker. The coke per 1000 cubic feet made averages about 44 lbs.; but from this has to be deducted the residue coke from the clinkering, which, as already stated, is used under the boiler. The amount of coke used will vary with the percentage of carbonic acid. Thus, if it is desired to reduce the carbonic acid to a minimum, more coke is necessary.

The percentage of carbonic acid in the crude gas at Hastings averages under 3 with No. 1 set, and under 4 with No. 2 set, which is probably satisfactory. Generally three tests for carbonic acid per day-shift are made by means of the Cooper tube. (It may be pointed out that unless fresh water is used each time with this test the results are not reliable.) The average length of time for the blow is four minutes, with a minute extra for every hundredweight of coke charged into the generator; a clear, clean fire being quite as necessary for gas making as to ensure a good supply of producer gas for the heating up of the other vessels. In the ordinary way, the producer gas will ignite immediately the blast on the carburetter is opened; but after every three or four runs, when either 3 or 6 cwt. of coke has been on, the ignition will be correspondingly delayed.

In this matter of blowing up or heating the vessels of the set, the question of labour can be considered. It is very desirable to select sober and intelligent workmen as operators, as a skilful operator can save much by properly regulating the production of producer gas and its combustion by the introduction of the secondary air at the proper point or points, and, among other things, obviate much unnecessary "roaring" at the stack-valve. Seven minutes' make has been adopted as the most satisfactory; longer and shorter periods having been carefully tried. Up and down runs for making are worked in the proportion of two to one; but the down runs are dispensed with some time prior to clinkering, to assist that operation. The valves which are used in this connection require constant attention while the set is at work, and should be examined internally when the set is standing off as spare. For operating them a rigid method of connection is very advisable. Likewise, the down gas-pipe may become partly blocked with dust, and should be cleared periodically. Leaky steam-cocks or a defective blast-valve will cause much trouble on a generator until the defect has been discovered and remedied. Other little troubles with ash-pan door, clinkering-doors, &c., are best met by keeping spare ones ready. Climbing clinker has not given any trouble; but this may be due to the fact that it is a rule to run the fire down and clear the same right out every two or three weeks, when opportunity is taken to examine the grate, linings, &c.

The wear and tear of the generator linings is, perhaps, not satisfactory. Trouble with local burning away has been experienced; and for every 25 or 30 millions made, it is found desirable to renew the bottom interior ring of lining at a cost for labour and materials of about £10. This is done as soon as a set is shut down, in order to be ready.

The carburetters installed were of the usual type, with oil-sprayers designed to spread the oil as much as possible. From the outset this plan of injecting oil on to the heated bricks was looked upon as very crude and unscientific; and, rightly or wrongly, the following defects were attributed to the method. It was difficult to keep the sprayers in clean and efficient condition, even though they were regularly examined; and in case of a block necessitating the removal of the sprayer, much time was lost. The oil, being forced by the pump through the meter and the heater, did not give a continuous supply, or spread the oil over the whole area of the chequer-work, causing excessive cooling of the same, and incomplete gasification of the oil. The cooling of the carburetter naturally needed the expenditure of extra fuel in the generator, and often caused the superheater to get unduly heated. The oil had to be shut off a certain time, according to circumstances, before the end of each run. After the blast on the generator had been opened a further period had to be allowed so that the stack-valve could be opened without oil vapour being lost, or presumably lost; and it is a doubtful point whether this "blowing-over" gas is of any permanent value. Ignition of the producer gas at the top of the carburetter was generally delayed; and frequently it caught with a "pop," or slight explosion. During the blowing up, the last traces of oil from the previous run would be observed burning on the bricks; and when the plant was shut down from shift to shift, oil vapour used to burn for some time at the stack-valve. Surely this was all loss of oil. In addition, the carburetter would become very dirty from carbonaceous deposits, and the top bricks of the chequer-work converted practically into pieces of carbon, which only gave a false heat when heated up. The carburetted water gas made at the time in question appeared to be of a very oily character, which tested well at the plant, but gave considerable deposit, and did not yield anything like its proper enrichment value. But, of course, it is very possible the plant was not worked as well then, when it was comparatively new to those concerned, as is

* An accident from neglect of this precaution has occurred, resulting in the destruction of a fan, &c.

the case now. However, it was deemed worth while making some endeavour to improve the carburetters, and this is briefly what has been done in that direction.

The flat top has been replaced by one of conical shape, extending about 3 ft. 11 in. above the floor; the angle of this top being the same as the interior of the crown lining, with the object of being able to distribute the oil over the whole area of the chequer-work. The top flange measures 7 feet from the top of the chequer-work, leaving a space, roughly, of 40 feet cubical contents for expansion and other purposes. A less depth of chequer-work has been tried, in order to secure a larger expansion-chamber; but it was not successful, as all the oil was not volatilized. A step is fitted on one side, in order to be able to see into the top sight-cock; but the glass by which the operator makes his observations is fixed close by the blast-valve at an angle, so that he can see when ignition has taken place —any shock or "pop" from an early ignition being much less marked since this top has been used. This space, of course, also becomes filled with gas during a run; and although means were originally provided to remove this, it has not been found to be of any consequence beyond now and then obscuring the sight-glass.

To overcome the objection of injecting oil on to the heated bricks, it is now put in by means of an atomizer operated by either steam, air, or gas. This atomizer converts the oil into the form of fog, with, perhaps sometimes a little oil dust, or very fine drops. Oil in this form is obviously in a ready condition for volatilization; and mixing as it does with the very hot water gas coming from the generator, it is doubtless partly thereby rendered gaseous—the heavier portions of the oil being converted in the passage through the chequer-work. It is well known that the volume of gas from the generator during a run decreases after the second minute; and thus it is desirable to reduce the oil in proportion. This point has apparently been already recognized in other plants, as also the necessity for thoroughly distributing the oil; but with the carburetter described, the oil is put in continuously (not intermittently, as with a pump) in decreasing amount coincident with the reduction in the volume of gas coming from the generator. It would probably take too long to describe exactly how this is accomplished; but it may be said that the oil is forced by way of the meters into a reservoir containing compressed air or gas, or steam at 50 lbs. per square inch, either through the oil-heaters or not, as desired. Thus the supply of oil to the carburetter is to this extent independent of the pumps. In the case of the atomizing force being gas or air, it is compressed and stored at 125 lbs. per square inch, and used at 50 lbs. per square inch and under; the compressor running at a constant speed regulated according to circumstances. Air has been used on account of safety since April, 1898. Steam, when employed, is taken from the main pipe through a reducing-valve into a small reservoir; but the condensed water is apt to become a nuisance.

Air and oil have to be supplied to each atomizer; but these are readily disconnected, and it is easy to remove an atomizer, renew or change the nozzle, and replace within 15 minutes. The nozzles are made in various sizes, according to the illuminating power required, and last a long time. The difference in the nozzles is mainly in the size of the holes; and a higher candle feet value for the oil is obtained with a No. 1 nozzle (finest holes) than with other sizes. Each atomizer is designed for working with the air and oil cocks full open; but there is a certain margin possible, for by using the air-cock partly closed the amount of oil passed is increased. This practice, however, is not recommended, as, if carried too far, it impairs the efficiency of the apparatus. In many ways this alteration has (compared with previous results obtained) proved successful; a saving of oil being effected, and a more permanent gas of uniform quality produced. During an ordinary run, the pressure-gauges of the generator, carburetter, and superheater are all on a level, and the stack-valve is usually opened, without the escape of oil vapours, within 35 seconds of the oil being shut off. There has not been any trouble with carbon in the carburetter, which keeps very clean, with the exception of dust coming over from the generator; and although hitherto this has been got over by removing the brick chequer-work occasionally, it will probably be better to blow the dust out in some way in future. New chequer-work for a time absorbs some of the oil vapours; and the lining of the carburetter and the pipes leading into it from the generator require attention occasionally, and it is advisable to have the covers off at the base of the vessel each time the set is shut down for changing over, to prevent dust blocking. Likewise, the blast or secondary air valve on the carburetter has to be remembered. In working, the heat of the carburetter should be carefully watched, since the heats required for different oils vary considerably. Too high a heat means the production of lampblack or carbon; and too low a heat, excessive production of tar, with semi-permanent gas. At Tottenham it is reported that too high a heat in the carburetter resulted on one occasion in naphthalene trouble in distribution; and the reason for this it would be interesting to know.

Coming now to the superheater, this is sometimes considered a superlative vessel. Theoretically it would appear that a gradual increase of heat from the top of the carburetter to the top of the superheater ought to be correct; but for volatilization in practice this is difficult, for it would mean "banging" at the stack-valve and other troubles. A "too hot" superheater is a great nuisance in water-gas manufacture; but with care this can be avoided. Every set will have peculiarities; and, for some reason, No. 1 set at Hastings has always been hotter than No. 2 in work, and especially with regard to the superheater. Oil vapour burning at the stack, too much blast on the generator in blowing up, and leaving the set standing with the generator top door open, are fertile sources of this trouble; and also, during clinkering, there is time for the superheater to get very hot. The operation should, therefore, be promptly carried out. In regular work, with uniform make, the heat of the superheater is kept under control by the work done in the conversion of any oil vapour passing forward from the carburetter. A hot superheater can be remedied in several ways—by carefully regulating the quantity of producer gas, or by making short blows, and so cooling the carburetter that the gasification of a considerable amount of oil vapour has to be done in the superheater. It is a good plan to test the gasification of the oil at a test-cock on the superheater; and a brown stain, free from oil spots, on white paper in the last minute of the run is considered satisfactory.

Stack-valves are apt to give trouble, especially when working with some tarry oils; but with a little perseverance the leakage can be reduced to a minimum. It will be found advisable to clean the faces after the plant has been standing for a while; for then the tarry substance will have lost its sticky or gummy nature and be converted into carbon, which will chip off. The centre pin of this valve may get brittle and break in course of time; so a spare one should be handy. No other trouble has been experienced; but the cover-plates are occasionally removed to examine chequer-work, and see that dust is not accumulating. With a clean set very little smell need be caused by the blowing up, beyond now and then a slightly sulphurous odour in the immediate neighbourhood; but the fine dust is apt to become a nuisance. A moderate blast presumably minimizes this; and it is found advisable to clear the roof and gutters regularly, especially in very dry weather.

The outlet for gas from the superheater to the washer or back (down-take) pipe requires cleaning every two or three weeks; and an examination even weekly is time well spent, for an unusual amount of carbon would at once indicate that the heat of the set had been too great for the oil. It is, however, important to distinguish between carbon as soot (the result of excessive heat) and the carbon which must of necessity form a coating to any pipe through which it passes under some pressure and at a high temperature. Of this latter, about a bushel is removed at each cleaning. The oil-heater coil is placed in the back pipe; and a slight coating of carbon to this is, doubtless, a valuable protection. As the back pipe seals in the washer on the ground floor, care has to be exercised when cleaning that no deposit falls and blocks the dip-pipe. The washer, in order to prevent deposits in the bottom of same, has a useful scavenger arrangement which is operated from the stage; and a good supply of circulating water is also connected. The washer requires periodical cleaning; and when this is done, it is flooded with the lower part of the scrubber up to a certain level, as indicated by a pet-cock. By this means all gas is expelled from the washer, and none can come back owing to the water seal at the base of the scrubber. It is, however, important to see that the bottom valve of the scrubber is sound, which can be done by means of the pet-cock already mentioned. In this operation it is

unnecessary for the men to enter the apparatus in any way—a practice which should be strongly guarded against, for crude water gas is very apt to remain about for a long time. The liquid from the washer passes into a seal-cup, and hence, by a 4-inch pipe, to the separator. The seal of the washer is adjustable; and a good stream of liquor should be kept running through the seal-pot, where it can be observed both as regards character and quantity. For night work electric light is provided at this point, as a naked light would be dangerous.

From the top of the washer the gas enters the bottom of the scrubber, a rectangular vessel containing wooden grids, down through which a stream of circulating water is kept running. The water enters the distributing arrangement by way of a pipe syphon, and has been always used in regular quantities. The character of this liquid is very important; for the presence of too much tarry matter will certainly cause trouble by blocking. A supplementary water supply is connected to each scrubber; and all liquid escapes by way of the washer and its seal-pot to the separator. The temperature of the gas at the outlet bend of the scrubber is at present the only guide to the heat of the set, and, as observed during a run, rises to about 172° Fahr. with ordinary oils. Some reliable and practical method of being able to ascertain the temperature of the vessels of the set would be a great advantage, instead of having to trust to the eye and to the heat of the gas.

Excessive washing or scrubbing of the gas should be avoided, and, indeed, it has been proposed to work the scrubber practically dry; but so far time has not permitted any careful investigations on the point.

From the scrubber the gas passes to the water-tube condenser, which is under cover, and was designed to serve both sets working simultaneously, if desired. A bye-pass main is provided, as also a tar seal-pot, communicating with the tar division of the separator. This seal-pot has a water supply laid on, and is periodically inspected, but has given no trouble; the tar keeping very fluid. It is endeavoured to keep the condenser at 60° Fahr. on the outlet; but during the hot weather this cannot be done, even though well (very cold) water is pumped through its tubes to the overhead boiler-feed and cooling-tank. Experience in this direction goes to show that a water-condenser is not the most suitable for water gas, and a plain 12-inch pipe condenser has been erected to improve matters. This introduces frictional condensation, and effects a reduction of about 5° to 10° in temperature, according to weather, but increases the pressure about $\frac{3}{4}$ inch. A small amount of oily tar is being deposited therein.

As already mentioned, the circulating water from the washers and scrubbers, and tar from the condensers, has to be dealt with in the separator; and in this connection most of the troubles of water-gas manufacture will arise. The separator now concerned is a steel vessel in a brick and concrete tank, and covered in with timber to avoid annoyance to the neighbours in the way of smells—the tar being very pungent. It is divided transversely with partitions, and has strainers and an inclined bottom, in order for the tar to gravitate to the proper compartment. The separation, so far, has not been satisfactory; but it is not in any way an easy matter. For one thing, the apparatus is evidently too small, and is kept too much agitated when the plant is working day and night. Better results are obtained when only one shift is worked, allowing the liquid to stand some ten or twelve hours; and in view of this, it is intended to provide another tank into which the mixture can be pumped to separate. From this proposed additional separator a new pump will be fixed, to raise the tar up to the siding level for sending away. Coal-gas liquor has been tried to assist separation without much success; but it was noted, when first the cooling water from the jacket of the air-compressor (used for the improved carburetter) was added to the hot effluent from the washer-seals, that the separation was better. But as this produced too much waste water it has been discontinued.

It should be noted that the liquid from the syphons of the plant is put into the separator, thereby adding a considerable amount of water, with some oil. Such tar as is produced is either burnt (not very successfully, owing to the contained water), thrown upon the coals, or sent away to the contractors who take the ordinary tar. The oily tar is not an acquisition in the retort-house, although it undoubtedly does improve the illuminating power; and that sent away has contained 50 to 60 per cent. of water, which should be remembered when comparing the figures given under the liquor made. The percentage of water in water-gas tar varies in a very remarkable degree; and it is a point to which very careful attention will be given as time permits, for it is obviously most important to convert the oil into permanent gas, and not oily tar. The amount of tar a given oil produces under the best conditions of heat, &c., has to be considered in comparing the relative values of different oils. The water circulating through separator, washers, &c., has to be pumped at very high temperatures (about 170° Fahr.), and hence troubles will arise. This water can be cooled somewhat by being passed through a coil in the feed-water tank on the way to its compartment of the same overhead tank; but, notwithstanding, very considerable wear and tear on the pumps has been experienced, the liquor attacking cast iron and steel with great vigour. The amount of water or liquor "makes up" somewhat, and the surplus is disposed of by evaporation under the retort furnace ash-pans. But care has to be exercised to see that the liquor is free from oil; and only specially appointed men are allowed to deal with it.

For better separation a centrifugal machine has been suggested; and this will, perhaps, have to be eventually tried. It is part of the engine-man's duty to look to the separator; and he has to see that there is a return flow from the supply tank—an operation at night-time which should not be done with a naked light (and again electricity is made use of). For use in the unhappy event of fire coal-gas liquor is connected close at hand; and a supply of sand is also kept ready.

The gas from the condensers passes direct into the relief holder, the contents of which are conveniently shown on an indicator in the engine-room. When first the plant was started, much oil collected in the holder; and on one occasion a quantity escaped by way of the water overflow-pipe, and caused many complaints in the town. Steps were at once taken to prevent this again occurring, but very little oil appears to be so deposited now.

Originally the crude water gas was drawn from the holder through the meter by the coal-gas exhausters, some distance away, and added to the coal gas at the outlet of the condenser, or at a point on the foul main from No. 1 retort-house. This plan was convenient, but it was bad for the illuminating power, and caused other troubles; so that now a new exhauster in the engine-room of the plant draws the gas from the relief holder and forces it through the purifiers.

As will be understood from the preceding paragraph, the water gas used to be purified in conjunction with the coal gas, and in the same boxes; but as the Hastings Gas Company have to work under the sulphur clauses, this plan was not a success. The oxide-boxes got very oily, resulting in their giving pressure, and the extra carbonic acid in the water gas quite upset the lime-boxes on several occasions, although it should be understood that the purification was really carried out for short periods successfully, working this way. Once during the time the "sulphur" went up to a very high figure, which was found to be due to sulphurous acid, evidently driven off in the oxide-boxes, which were not often used afterwards. For the past eighteen months or so, the purification has been carried out in part near the plant itself; two old 20-foot purifiers being made use of. From these the gas passes into the outlet main of the coal-gas lime-boxes, and the mixed gases are dealt with in the catch-boxes Nos. 7, 8, and 9; No. 7 being lime and Nos. 8 and 9 oxide. It is not easy to remove the last traces of sulphuretted hydrogen from the mixed gas, especially under some conditions; and although the boxes may give a clean lead-paper test, a slight trace may be obtained in a twenty-four hours' test. Some oil used to be deposited in this mixing-main before the improved carburetter was adopted; but now the condensation from the syphons thereon is only slightly oily. It is a curious thing, in view of the nature of the gas, that water gas should carry so much aqueous vapour; but that this is so can be readily demonstrated by testing with slate on the outlets of the coal and water gas lime-boxes respectively. If this water vapour goes forward in the mixed gas, as is probable, and comes down with change of temperature, it would be a means of assisting the deposition of naphthalene, if present in the coal gas. For purification, both lime and oxide have been tried, separately and conjointly. With the purifiers trouble at once arose, owing

to oil being deposited on the bottom layers of the material therein; and to overcome this, in some measure, coke is introduced into the space below the first row of grids with satisfactory results. The coke is changed once or twice a year, although, at the present time, comparatively little oily matter reaches the purifiers, which are used in rotation.

Oxide appears to have (and especially so when new) a very marked detrimental effect on carburetted water gas, and becomes sticky with oil, which, however, disappears to some extent during revivification in the atmosphere. Air can, of course, be drawn in with the gas to assist matters, and this was one point considered to be in favour of using air for atomizing the oil in the improved carburetter. (How much of the 2 per cent. of air passes into the purifiers is a doubtful point, under investigation.)

Generally speaking, when oxide is used for purification, the carbonic acid in the gas would be ignored; the volume of purified gas being benefited to the amount of the same. At Hastings, however, oil, owing mainly to transport, is very expensive, and may be considered at the present time as no less than 4d. a gallon. Thus it becomes a question which is the more economical plan—to use more oil, or remove the carbonic acid; and the latter having been found to be advisable, lime has, as a rule, been used.

Such investigations on the point as it has been possible to make up to the present time, tend to show that the illuminating power of the carburetted water gas is diminished by ¾ to 1 candle for every 1 per cent. of carbonic acid therein. Thus, as lime purification for water gas costs from 2½ to 3 times as much as for coal gas (say, 1½d. per 1000 cubic feet at Hastings), it is obvious from a rough calculation that it is cheaper to purify from, than enrich to compensate for, carbonic acid, as under most favourable circumstances the illuminating power would be reduced 3 candles by the carbonic acid, and oil to compensate would cost 2d. (against 1½d.), added to which there are other practical difficulties in raising the enrichment to the necessary extent.

Lime in one box and oxide in the other has been tried; but as the boxes have to be worked in rotation, this method was not satisfactory. In full work, on an average, each of the two limes has to be changed once a week, and is run until the carbonic acid on the outlet has reached 0·4 or 0·5 per cent. and the sulphuretted hydrogen is quite strong. These impurities are further dealt with at Nos. 7, 8, and 9 boxes already mentioned. Carbonic acid and sulphuretted hydrogen going into a lime-box cause, owing to the chemical reactions, great rise of temperature. This is very undesirable, and more especially in summer time, when after the temperature of the gas has been reduced by the condensers, it is raised again by the purifiers, and it is possible another plain condenser, or rather cooler, will have to be erected on the outlet of the purifiers. The two additional 30-feet purifiers now being erected may, however, be of some benefit in this connection. Experience will decide the best plan of working; but probably it will be an oxide and a lime alternately, for the connections are designed with a view to four purifiers working in rotation, either Nos. 1 and 2 first, and Nos. 3 and 4 last, or *vice versa*.

It is hoped to reduce the cost of purification by using some oxide as well as lime, and relieve the other purifiers Nos. 7, 8, and 9 of work they have hitherto been called upon to perform. The disposal of the spent lime has to be considered, for it will always be slightly affected with oil; and although no serious difficulty on this account has been so far experienced, it is another inducement to reduce the amount of lime to a minimum.

Changing carburetted water-gas purifiers requires considerable care, if nuisance is to be avoided, which is not always easy when the neighbours watch the operation from their bedroom windows—a remark, perhaps, those present who know the Hastings Gas-Works can appreciate.

It is now the practice to allow a box that is to be changed to stand off some time previous to the cover being raised, with the air-plug open, and air can be forced through by the fans. (It is unwise to have a permanent connection for this operation, as gas might get back into the fans, which it should be remembered are in direct communication with the generators.) By such means the spent lime cools; and can be removed without much trouble, except in windy weather, when the lime, being so dry, flies about, and the men have to wear eye-protectors.

It will probably be agreed that the success or otherwise of a carburetted water-gas plant of any kind depends greatly upon how it is managed; and this being recognized, the importance of skilled supervision becomes evident. The uniformity of the results obtained may also in some measure be taken as a criterion of the efficiency of the supervision; for all practically acquainted with this manufacture will appreciate how difficult of accomplishment this really is, and particularly so under some conditions.

Primarily intended—as it was with us—for the enrichment of the coal gas, the water-gas plant is being worked accordingly; the illuminating power made being regulated as desired to give 15¾ to 16 (15 is the standard) candles on the mixed gas at the meter, where it is tested hourly in preparation for the night consumption. This plan of testing entails considerable work; but the results are most satisfactory. For about five months of the year a night and day shift (10 hours each) are worked, but a day shift only in the other seven months. The ordinary shifts allow about 20 per cent. margin in case of emergencies and repairs; but doubtless it might be said that the plant under these circumstances is not worked to the best advantage, which is admitted so far as results are concerned. The local circumstances, however, justify the arrangements stated; and indeed, this last winter coke has been so short that the quantity used in the plant could have been easily disposed of at a good price. The two hours' interval between shift and shift in winter has not been found to be of any practical consequence; but it is otherwise with the 12 or 14 hours interval in summer. The greater part of the testing having to be done during the daytime, care has to be taken that returns for the night shifts do not influence the results obtained; and this is done by keeping the oil used per 1000 cubic feet as near as possible to the same figure as on the day shift.

The two ordinary shifts produce gas equal to an average of five coal gas-retort beds (14 or 15 men), and the reserve is equal to another retort bed. This is, of course, an important aspect of the matter, and the value of the plant was strikingly illustrated in the recent spell of cold weather in March. Twelve retort beds were in use, and the plant was working long (12 hours) day shifts, with a good stock of gas in hand. But with snow on the ground the consumption went up by leaps and bounds; and the position would have been critical ere three or four retort beds could have been got into work, and men found. As it was the plant was worked full until the crisis was over. It was during this period that gas was sent out containing upwards of 36 per cent. of carburetted water gas—the highest we have reached, as 33⅓ per cent. of the daily maximum make is all that is usually desired.

It is preferred to supply coal gas from down to within an hour or so of sunset, and coal gas enriched with carburetted water gas during the lighting hours—a plan which can be readily carried out, except just at midwinter, when the gas will be the same practically throughout the 24 hours. In this way the consumers get good illuminating power when really required; and water gas at Hastings has enabled the candle power to be maintained in a way never attainable before, and the sulphur compounds to be reduced to a minimum. No trouble of any serious kind has been experienced beyond its having been found desirable to increase the pressures at the works, to overcome the sluggishness of the mixed gas, as compared with coal gas; and the difference in the day and night gas may affect gas-engines, unless these have been adjusted accordingly.

At this time of the year, when the plant is only worked one shift, the percentage of water gas is not correctly represented by the percentage of the daily total gas made, for it is only added to the coal gas during the day for consumption the same night. In this way a considerable percentage might now and then be used—a point of some importance in view of proposed restrictions on the amount of carbon monoxide or carbonic oxide.

Thus, while in water gas for enriching purposes it is found most desirable to reduce the carbonic acid to a minimum, it would be a positive disadvantage in regard to the carbonic oxide if restrictions are to be made; for carbonic acid and carbonic oxide vary, as 1 to 2 in the case of the reduction of carbonic acid to carbonic oxide. Thus—

$$CO_2 + C = 2\,CO.$$
$$44 + 12 = 56.$$
$$22{\cdot}32 \text{ vols.} = 44{\cdot}64 \text{ vols.}$$

If, therefore, the gas contains 4 per cent. of carbonic

acid and 30 per cent. carbonic oxide, reducing the carbonic acid to 2 per cent. increases the carbonic oxide to 34 per cent. When carbonic oxide is burnt to carbonic acid, curiously enough there is not any alteration in volume. Thus—

$$2 \text{ vols. } CO + 1 \text{ vol. } O = 2 \text{ vols. } CO_2.$$

The volume of carbonic oxide varies from 30 to 34 per cent. in purified water gas, as against, say, up to 9 per cent. in coal gas. In view of these figures, it will be evident how a limit of 12 per cent. carbonic oxide would seriously interfere with arrangements which so far have been highly satisfactory to all concerned. A mixture of 66⅔ per cent. of coal gas and 33⅓ of water gas, as already described, would give $(66\frac{2}{3} \times 9 + 33\frac{1}{3} \times 30) = 16$ per cent. of carbonic oxide. This, too, is only an ordinary case, and has not any regard to emergencies. Testing for the amount of carbon monoxide is now a matter of importance, and even with probably the most convenient apparatus (Hempel's) takes some considerable time, which is of consequence in medium-sized works, not large enough to employ an analyst entirely. Although other tests are talked of, the only general absorbent for carbonic oxide now in use is a saturated solution of cuprous chloride in hydrochloric acid; but this is rumoured to give high results. In the ordinary way of making the test the carbonic acid and sulphuretted hydrogen, if present, have to be removed together with oxygen and illuminants before the carbonic oxide; and investigations are, therefore, now being made with a view to ascertain whether it is not possible by the direct application to the gas of a suitable strength solution of cuprous chloride to absorb the carbonic oxide in preference to the other constituents. Some of these are affected by a saturated solution (oxygen, acetylene, and the ethylene group). So far it can only be said that 10 grams of cuprous chloride in one litre of hydrochloric acid results in a solution, which, when fresh, yields concordant results (if anything, giving results slightly less than the actual) when used on purified carburetted water gas, as per results as under—

Date.	Absorption by Special Solution.	Percentage of Carbon Monoxide as shown by Ordinary Test.	Difference.
1899.			
March 29	(*a*) 32·4	..	..
	(*b*) 32·4	..	..
April 10	31·6	32·0	0·4
,, 12	32·6	32·6	Nil.
,, 13	33·4	33·8	0·4
,, 14	32·0	32·4	0·4

See Appendix for other tests *re* carbon monoxide.

The labour on the plant is as follows: The operator in charge, who works the apparatus and looks after all on the stage, the coke lift, and overhead circulating tank, assists in the clinkering, and has definite instructions to report immediately any defect or abnormal circumstance in the working of the plant. The engine-room man is responsible for all on the ground-floor, with separator, oil supply, &c., and assists with coke supply and clinkering. The coke-man takes part in the clinkering, assists in keeping the plant clean, and brings the coke from the yard; he also removes the generator ashes and other fuel to the boiler house. Another man, from the coal-gas section, assists at clinkering—making four men at this operation. All the steam for the whole of the works comes from the same boilers; and it has been found, by careful measurements of the water used, that the proportion of steam required by the water-gas plant is about one-third of the whole. It may be of interest to note that in full work this means about 6 gallons of water per 1000 cubic feet of water gas made. Calculated on a production of 200,000 cubic feet per shift, the cost of the labour just described for manufacture (including half the boiler-men's wages, not one-third) may be taken at 1d. per 1000 cubic feet. Similarly, the purification costs about 0·33d. (labour only). The heavy wear and tear has already been referred to; and a fitter is, practically, entirely engaged on the work. The average labour (including proportion of boiler repairs) may be considered as about 0·33d. per 1000 cubic feet. It is only fair to state that some wear and tear has hitherto been altogether exceptional, and is being remedied. The total recorded cost of material required for repairs and spare parts since the plant was started has been about £250; and 135 million of gas having been made, this is equal to 0·45d. per 1000 cubic feet added to the labour—a total for wear and tear of 0·78d. per 1000 cubic feet. Additions and alterations to the original plant have cost about £600 (exclusive of new purifiers). The cost of supervision is not great, being undertaken by the existing staff. Careful supervision repays itself in many ways. Thus, a quarter-of-a-gallon of oil per 1000 cubic feet inefficiently used, or more than necessary for the required enrichment, would mean a loss of £2 10s. in one shift at Hastings—a sum which would pay for a large amount of supervision and testing.

For comparisons between respective water-gas plants to be of any real value it is most important for all the influencing conditions to be clearly shown.

Thus, the comparison will be influenced by: (1) The size of the plant. (2) The purposes for which the plant is used (*i.e.*, for enrichment, &c.). (3) The kind of oil used. (4) The temperature at which the gas is being measured. (5) The purification (whether carbonic acid is eliminated). (6) The point and temperature at which the gas is tested. (7) The mode or standard of testing. (8) The amount of tar produced.

At Hastings, to summarize, the gas is corrected for temperature (the meter being fixed in a very unsuitable position); is purified for carbonic acid; and is tested, under the most severe conditions, a considerable distance away. The standards employed are: (*a*) candles; (*b*) 16-candle pentane; and (*c*) Simmance's one-candle (new). The latter (*c*) gives somewhat higher results than the others. The water gas is consumed for the first test (*a*) in a Sugg's 20-candle standard argand, and for (*b*) and (*c*) tests, in a No. 1 London argand.

All the tests are corrected for temperature and pressure in the usual way; but this results in very funny figures at times. Theoretically, of course, it is quite right; but there are times when gas made one day will test better the next, owing to the alteration in the tabular number—the gas evidently not exactly following the theoretical conditions. The temperature at which the gas is tested is under control usually; but no such control exists in regard to the atmospheric pressure, which varies to an extent not always perhaps conceived, with the resultant alteration in the tabular number for correction. The point at which the gas is tested is important. The connection to the laboratory is taken off the water gas main just before its junction with the mixing main, and the gas is passed through a small oxide purifier to remove any traces of sulphuretted hydrogen.

The endeavour is to produce as permanent a gas as possible, which the condition of the mixing main and purifiers Nos. 7, 8, and 9 is considered to prove is the case. Thus, in the ordinary way, tests obtained on the separate photometer at the plant correspond practically with those recorded in the laboratory. If, however, the operator's test-light (the gas from the outlet of the condenser is passed through a small lime purifier on the stage for this light) is connected to the photometer at the plant, the results obtained are some 10 per cent. and more higher than the laboratory; and the difference used to be very much more marked. Ten per cent. added to the oil values given would materially improve the same. Possibly something might be done with advantage in the way of returning some partly purified coal or water gas to the condenser; and this point will be investigated.

There is, without doubt, an efficiency limit to the illuminating power of carburetted water gas; and obviously the more oil per run used the more work the set has to do. As to the limit, opinions will, of course, differ; but does it not vary according to the oil used? The gas is, after all, to a large extent a mechanical mixture, and part of the oil may be considered to be mechanically suspended by the non-illuminating constituents. If this is so, it is only reasonable to suppose that such constituents can only carry a certain amount of oil properly, and any more will be deposited or wasted. The illuminating power required at Hastings varies from 18 to 22 candles; and it is preferred to have to make the lower quality. Both Russian and American oils have been used. American oil has given rather better illuminating value, but has a low flash-point compared with Russian Solar Distillate.

The best results have been obtained from some (discoloured) refined American petroleum, which was very clean in working, made little tar, and gave a high illuminating power gas. Its use, however, is attended with more

risk than the other oils mentioned. There are two modes of expressing the oil value.

1.—Candles per gallon =

$$\frac{\text{Illuminating power of gas in candles.}}{\text{Oil used in gallons per 1000 cubic feet.}}$$

$$\text{As } \frac{\text{21 candle power}}{\text{3 gallons per 1000 cubic feet.}} = 7 \text{ candles per gallon.}$$

This is a simple method, and useful to calculate how much oil is required to give a certain candle-power gas when the value of the oil in candles per gallon is known.

2.—Candle-feet per gallon =

$$\frac{\text{Gas made} \times \text{illuminating power.}}{\text{Oil used} \times 5 \text{ cubic feet.}}$$

$$\text{As } \frac{200{,}000 \times 21}{600 \times 5} = 1400 \text{ candle-feet per gallon.}$$

This method is preferred, as perhaps more scientific; for it will be seen that the 5 cubic feet per hour rate, as used in the standard tests, is taken into account. It may also be noted that candle-feet per gallon is 200 times greater than candles per gallon.

A list of candle-feet per gallon values is given here; and the operator tries to reach 1500 candle-feet in his working per gallon of oil; but this value is not often obtained. The highest weekly record is 1483 candle-feet when making 18·19-candle gas with a very favourable tabular number (under 0·950). The average value, as returned, is more about 1300 = 6·5 candles per gallon.

The Illuminating Power that should be Obtained with Various Quantities of Oil Used at Different Oil Values.

Oil per 1000 Cubic Feet.	Illuminating Power. Oil Values.				
	1300	1350	1400	1450	1500
2·0	13·00	13·50	14·00	14·50	15·00
2·1	13·65	14·17	14·70	15·22	15·75
2·2	14·30	14·85	15·40	15·95	16·50
2·3	14·95	15·52	16·10	16·67	17·25
2·4	15·60	16·20	16·80	17·40	18·00
2·5	16·25	16 87	17·50	18·12	18·75
2·6	16·90	17·55	18·20	18·85	19·50
2·7	17·55	18·22	18·90	19·57	20·25
2·8	18·20	18·90	19·60	20·30	21·00
2·9	18·85	19·57	20·30	21·02	21·75
3·0	19·50	20·25	21·00	21·75	22·50
3·1	20·15	20·92	21·70	22·47	23·25
3·2	20·80	21·60	22·40	23·20	24·00
3·3	21·45	22·27	23·10	23·92	24·75
3·4	22·10	22·95	23.80	24·65	25·50
3·5	22·75	23·62	24·50	25·37	26·25

Surprise has been expressed that better results are not obtained from the oil with the improved carburettor than those given. It will have been noted that the oil is not wasted in the form of lamp-black or tar, for of the latter from the separator (which also has to receive any liquid from the syphons), when the 50 to 60 per cent. of water is deducted, there is under 10 per cent. of tar and tar oil. Nor is any serious amount of oil deposited in the purifiers. Hence the natural question is, if greater illuminating value is in the oil, what becomes of it?

It may be that in the desire to secure a permanent gas the efficiency suffers, or that the conditions of testing are comparatively too severe. It is also only right to state that the figures given for oil used are slightly above the actual; the meters, from circumstances of position and policy, registering somewhat fast.

The investigations at Hastings are, of course, far from complete; and one of the most interesting points now under consideration is using compressed gas instead of air as the power for the atomizer.

This account of individual experience will, the author hopes, suggest many points for discussion to the mutual advantage of all concerned. There will, of course, be some here to-day to whom much of what has been said will be very elementary knowledge, after their many years' experience in the manufacture of water gas; but to those who, like the author, are comparatively new to it, it is hoped the paper may prove of interest and possible advantage.

[At the end of the paper some weekly returns of working were given for 1898 and the present year, together with working directions for the operators of the plant.]

Appendix.

Tests on Purified Carburetted Water Gas for Carbon Monoxide (CO).

Date.	Absorption by Bromine, Nitric Acid, and Alkaline Pyrogallol.	Percentage of Carbon Monoxide.	Percentage of Carbon Dioxide (Unpurified Gas).	Illuminating Power.	Make per Run.	Coke Used in Generator, per 1000 Cubic Feet.
1899.				Candles.	Cub. Ft.	Lbs.
Feb. 25	12·6*	30·2	2·3	18·29	4964	44·58
,, 27	10·8*	32·9	2·3	17·81	4880	44·37
Mar. 1	10·4*	31·2	2·2	17·97	4847	42·40
,, 3	6·6*	33·9	1·9	20·27	5011	41·31
,, 9	12·5	32·0	2·6	19·41	4790	42·40
,, 10	13·3	31·0	2·6	18·44	4752	43·24
,, 11	14·2	30·9	2·4	18·65	4604	40·72
,, 27	10·4	32·3	2·8	17·59	4906	39·81
,, 28	11·3	32·7	3·1	18·37	4800	46·66
April 5	11·5	34·3	2·2	20·06	4619	41·56
,, 10	13·3	30·5	2·6	20·65	4578	50·20
,, 10	12·6	32·0	2·2	20·48	4578	50·20
,, 11	12·6	33·0	2·1	19·60	4731	43·29
,, 11	12·9	32·3	..	19·76	4731	43·29
,, 11	12·4	33·4	2·3	18·68	4731	43·29
,, 12	12·8	33·1	2·1	20·33	5024	39·14
,, 12	14·4	31·8	..	20·65	5024	39·14
,, 12	12·9	32·6	2·0	19·41	5024	39·14
,, 13	12·6	33·2	2·0	†	5025	33·43
,, 13	12·0	33·8	2·2	†	5025	33·43
,, 14	13·0	32·4	2·5	21·20	5219	36·11

* Nitric acid not used in making these tests. † Tests unreliable.

Tests on Enriched (Mixed) Gas for Carbon Monoxide.

Date.	Absorption by Bromine, Nitric Acid, and Alkaline Pyrogallol.	Percentage of Carbon Monoxide.	Percentage of Carburetted Water Gas on Total Gas Made.	Date.	Absorption by Bromine, Nitric Acid, and Alkaline Pyrogallol.	Percentage of Carbon Monoxide.	Percentage of Carburetted Water Gas on Total Gas Made.
1899.				1899.			
Feb. 28	5·8*	11·9	30·76	Mar. 25	6·4	14·8	35·87
Mar. 1.	5·5	12·6	30·83	,, 27	6·6	14·7	18·46
,, 2.	6·4	12·7	31·31	,, 28	7·8	14·3	13·62
,, 3.	5·9	12·9	31·73	,, 30	7·3	15·5	18·68
,, 4.	3·3	12·7	31·72	April 6	7·1	14·4	17·44
,, 9.	7·5	15·1	30·58	,, 7	7·6	14·1	17·44
,, 10.	8 4	13·9	30·46	,, 10	7·1	11·5	16·02
,, 20.	13·6	14·4	17·45	,, 11	7·2	13·9	17·03
,, 21.	6·2	14·2	20·05	,, 12	7·3	14·0	18·11
,, 22.	7·5	14·3	34·88	,, 13	7·6	14·9	17·44
,, 23.	6·6	14·1	36·27	,, 14	7·9	13·6	18·40

* Nitric acid not used in making this test.

Discussion.

The President said Mr. Botley's paper was a very practical and thoroughly readable one; and to those who were thinking of starting a carburetted water-gas works, the hints were of the utmost value. He was sure it would give Mr. Botley great pleasure to answer any questions the members might like to put to him, and to hear opinions on the matter.

Mr. J. W. Helps (Croydon) was sure the President was perfectly right in stating that the managers of gas companies about to start the manufacture of water gas would find in Mr. Botley's paper a great deal that would be of assistance to them. They might be frightened too much at the mass of detail, which foreshadowed the difficulties to be overcome. If it did not frighten them, they would benefit from Mr. Botley's experiences. It would also, he was sure, be of some value to students in looking up the value of water gas. No exception could be taken to the paper from the point of view of its completeness. Looking at it from the standpoint of those managers who had been using water gas for some time, he must confess to some feelings of disappointment. He expected, knowing how Mr. Botley had studied the subject, that he would have given them certain figures and facts which would have been of more use to those who had been using water gas for some time past. It seemed to him there was only one point in connection with the paper which was new—that was the way in which oil should be introduced into the carburetter. He had seen the plant in work

at Hastings; and Mr. Botley had shown him the manner in which the oil-spray had been introduced into the carburetter. He must confess he came to the conclusion that Mr. Botley was doing the thing in the right way. He showed him the condition in which the oil-mist went into the carburetter; and if he could possibly maintain the condition of the oil-mist inside the carburetter as well as he could when it was outside the carburetter, he could not help thinking that the manner in which he was doing the work was bound to be successful. The whole thing appeared to him to resolve itself into a question of £ s. d. With the plant he (the speaker) had, the oil did not fall directly on the brickwork of the carburetter, but on two or three layers of wrought-iron bars; and the oil was volatilized in a different manner to the process of which Mr. Botley spoke. He had been looking at the figures given in the appendices to the paper; and he should have thought the candles per gallon would have worked out much better than they had heard of. Mr. Botley was obtaining about 6, or something under 6¼, candles per gallon per 1000 cubic feet. He did not know if this was a better result than he was securing previously. If he would give them a comparison, it would help them. The oil question, after all, was the most serious one. Mr. Botley stated that by the use of oil in the sprayed condition, he was enabled to regulate the oil in the carburetter; and he also said that by his process he was enabled to greatly reduce his water-gas tar. From the latter fact, he deduced that he was practically volatilizing the whole of the oil which went into the carburetter. He made the remark that it was necessary to clean out the down-pipe from the superheater to the washer every three weeks or so, because it got choked up with carbon. He thought the whole solution of the question was that he did not get the oil into the holder because he turned it into carbon somehow. He did not find it necessary to clean out so often. He did not think it would be of interest to those present if he went into details of the figures he had obtained at Croydon. They were nearly a candle per gallon more than was obtained by Mr. Botley; and if he wanted to prove that his system was a correct one, he should see the Croydon works. The coal and the oil Mr. Botley was using were the same as his (the speaker's); and the results of pure water gas and the mixture of coal gas and water gas were the same. But the illuminating results were not alike. There were many points in the paper to which he should be glad to draw attention; but he had indicated a matter on which he wanted some information.

Mr. F. W. Cross (Lea Bridge) said the point which Mr. Helps had mentioned in regard to the deposit in the down-pipe to the washer, had also occurred to him. He thought Mr. Botley worked at low heats. If he worked the superheater at low heats, he should not get any deposit in the pipe leading from the superheater to the washer, which should require removal within three weeks or a month. It appeared to him that, working at low heats with his atomizer, he had deposited some of his oil in the down-pipe which should be in the gas. There was one point brought out prominently in the paper which might have some bearing on the low candle efficiency that Mr. Botley had obtained, and that was the oil he got in his purifiers. He never saw the slightest trace of it in his (the speaker's) purifiers; and it appeared to him that Mr. Botley must be losing some of his oil in this way. If he freed the oil from the purifiers, he (Mr. Cross) took it that he got it in the gas. There was one other point. Mr. Botley said he was sending out his tar with from 50 to 60 per cent. of water. He could not understand such a high percentage as this. True, the tar must have some percentage of water in it, and a high percentage; but he should say that between 20 and 30 per cent. was the outside. The amount of water in the tar might be easily reduced by evaporation or steaming through the ordinary tar-doors. If they put a steam-coil (even a primitive kind would do), the water could be driven down to 10 per cent.

Mr. A. E. Broadberry (Tottenham) wished to express his thanks to Mr. Botley for the useful paper he had read. He had entered very deeply into detail; and among the thousand-and-one points he had put into his paper, there were certain to be a few that some of them would disagree with. As to purifiers, Mr. Botley said they should be in the open. Of course, it was generally considered that the purifiers were better roofed in; and he did not see much more reason for putting water-gas purifiers in the open than he did coal-gas purifiers. When they were going to empty water-gas purifiers, they always aired them by blowing air into them. They did not do it with a fan; they did it with a separate blower, which they used for the purpose. They did not find any great risk. In connection with purification, too, Mr. Botley said it was difficult to remove sulphuretted hydrogen; but he (the speaker) tested his gas with a constant test-bottle for a week straight away. The lead papers would stand a week's exposure; and if they would do this, they would stand anything. It was true the oxide got a little oily; but the oxide they now employed had been in use for 4½ years. Most of the troubles of Mr. Botley were individual troubles; and he did not think they need deter anyone from erecting carburetted water-gas plant. Mr. Botley had spoken of explosions, and so on; and someone might be led to think they must expect them. By Mr. Botley's courtesy, he had visited the works at Hastings some time ago; and he did not hear a "pop" there. There were "pops" in his Mr. Broadberry's) own works, but not so frequent as the "pops" from coal-gas retorts. With regard to purification, there was another point in which he did not agree with Mr. Botley. He said it was cheaper to remove the carbonic acid than to enrich against it. It might be easier, but it was not cheaper, to do so. Supposing they added 4 per cent. to the bulk of gas, Mr. Botley said there would be a reduction of from 3 to 4 candles. He had never found it so. He thought the reduction would be 1½ to 2 candles. He did not know whether Mr. Botley had allowed for the extra bulk of gas; but the extra bulk would go to the consumer, and it represented ½d. per 1000 cubic feet. With regard to naphthalene, he had experienced that, when they had got the chequer-work too hot, they produced naphthalene from carburetted water gas. In one well, where there was a self-acting syphon, they found a good many flakes of naphthalene round it. At the same time, it was a very insignificant amount as compared with what was made by coal gas. After all these points of disagreement, he came to the new sprayer. Mr. Botley very kindly did for him the same as he did for Mr. Helps. He took the sprayer from the carburetter, and directed it across the floor. In the horizontal position, the sprayer might not answer so satisfactorily as in the vertical position; and this he could appreciate. But working it at that disadvantage, when he drew the sprayer out, it blew the oil out in so fine a mist that it blew away. If they could put their oil into the carburetter in this condition, it was much more favourable for the purpose of gasifying the oil than putting it in in a heavy shower. But it certainly did not seem, from Mr. Botley's figures, that there had been the very great increase in illuminating power in the results that he would have expected from the device. The other speakers had mentioned the finding of lamp-black there; but Mr. Botley said he had less lamp-black in the take-off pipe. With regard to the sprayer itself, Mr. Botley said he obtained the best results from his sprayers having the smallest holes; and if he wanted to put in more oil, and he used larger holes, he did not obtain such good results. He would suggest that he should put in more small holes. Mr. Botley cleared out some chequer-work from the carburetter; but he did not find any advantage from that. And this led him (the speaker) to wonder whether it was necessary to add the cone at the top of the carburetter. If it was not necessary, it would simplify the adaptation of his spray to ordinary plant. Undoubtedly Mr. Botley's sprayer was a good idea; and he thought in future he would be able to lay better figures before them than he had done in his paper.

Mr. T. May (Richmond) remarked that the figures which had been given in the paper seemed to point to the fact, not that the sprayer was wrong, but that the plant was wrong. Mr. Botley had wrong plant. If the sprayer could be applied to other plant, better results could be obtained.

The President asked what plant was erected at Hastings.

Mr. Botley said the plant was erected to the designs of his Senior.

Mr. S. Meunier (Stockport) said he must congratulate Mr. Botley upon his practical paper. He had particularly admired the truthfulness with which he had put down the various costs. He should judge, from his own experience, that, taking into consideration the various local circumstances which arose, they might be adopted for reference as sufficiently close for managers to go by if they were

thinking of putting down carburetted water-gas plant. The main feature in the paper was that Mr. Botley's oil results did not appear equal to what some of them were obtaining. Certainly 6½ candles per gallon was not a result he should have expected, from what he had heard and seen at Hastings as to the spraying arrangements. He was disappointed. Judging from that standpoint, he expected a great deal; and he was sorry Mr. Botley had not been able to give them some figures which were a "best on record." Evidently, the fault lay not so much with the sprayer, as with the heats used in the plant, or something in the manipulation he had not yet discovered. Mr. Botley made the remark that they wanted to choose sober, intelligent men. This, of course, with a plant of the kind was an absolute necessity. He only wished they were able to get them. Whether they were to be secured in the South he did not know, but there was an extreme difficulty in getting them in the North; and he put down the several peculiar results he had attained very much to this. Human nature was human nature; and men's eyesight varied—particularly when there was no one about. Results varied somewhat. He had had anything from 5 candles up to 8 candles per gallon. The latter figure they could not maintain; but taking the average, they could strike something in the neighbourhood of 7½ candles, which was a very good result. He had been of opinion for some time that there was more in carburetted water-gas plant than they had discovered. But something was required to facilitate the ease of working, and to do away with the element of the working man. There was another thing he had noticed, and that was that the plant used 15 gallons of oil in seven minutes, and obtained a very high yield per run. Using the same quantity of oil in the same plant, he found no difficulty in getting 22 to 23 candle gas. He had been smitten with the idea that water-gas tar was worth more than coal-gas tar; and he had been trying to come to a conclusion on the point. The analyses they had been making showed some peculiar things. They found a great deal of naphthalene in the tar itself at one time; and at another they discovered a great deal of benzol, and no naphthalene. They wanted to find regular results. Another of the figures mentioned by Mr. Botley was with regard to the cost of renewing the lower portion of the lining, which he had put down every three or four weeks. This was a very short time indeed. Whether it was due to the quality of the blocks he used, he knew best; but judging from the cost, he must be paying for something good, whether he had it or not. He (Mr. Meunier) renewed every two months; but instead of costing £10, it cost only £4 10s. There was a great deal of difference between £4 10s. every two months and £10 every four weeks; and this was certainly an item to be taken into consideration. The fact that Mr. Botley only attained 6½ candles per 1000 cubic feet was due to his heat being low; and this was further borne out by the fact that he mentioned in his paper that there were "pops." If he kept his heat sufficiently high to ignite the gases immediately, he would have nothing of that kind, and he might get better oil results. There was another point he mentioned about low-flash oil—"The best results have been obtained from some refined American petroleum, which was very clean in working, made little tar, and a high illuminating power gas. Its use, however, is attended with more risk than the other oils mentioned." He should like Mr. Botley to explain in which way he found, or suggested, there were more risks in working with that oil than with the ordinary oil most of them had; because when they took their oil from the tank it was in an enclosed space, and free from any liability of contact with the air. He thought Mr. Botley's paper would be handy for reference in the future.

The PRESIDENT said that, before closing the discussion, he would like to make a few remarks. He had not a water-gas plant himself, and was therefore unable to follow much of the valuable information contained in the paper. He was about to put one down a year or so ago; but he was waiting to see the results of the benzol system, because he was pinning his faith to uncarburetted water gas. He should like to mention the sprayer. Mr. Botley laid great stress on that, and he thought he had every reason to do so. Twenty or twenty-three years ago he was asked by an American firm to report on an apparatus for oil gas on the Pintsch system. He experimented on it for some months, and obtained fairly good results; but instead of dropping oil as they did upon heated pipes, he thought he should secure much better results by spraying the oil into the heated tubes. He did so. He took out a patent for it; and the results he obtained were such that he disposed of the patent to considerable advantage, and it had been used in many processes since. But he had realized far superior results by spraying oil into tubes, instead of allowing it to trickle in. At Vauxhall, he tried the spraying of oil with steam into retorts; but he was then handicapped by having other matters to attend to, and so let it drop. The spray process was a distinct advantage over trickling oil on the chequer-work. Mr. Botley had mentioned in his paper the separation of tar and water by a centrifugal machine. This centrifugal machine was a Danish patent; and he had the privilege of employing and perfecting the first one made. It was originally intended for separating milk and cream; and hundreds of thousands of the machines had been in use all over the world. They thought that they might employ one on the gas-works for separating tar and liquor; and he made many experiments. He found he could get excellent results. Mr. Irminger had worked the system since; and if Mr. Botley would try this centrifugal machine, he would be able to separate the oily tar and water to his utmost satisfaction. With reference to the dust-arrester, everyone who worked a water-gas plant had great difficulties to contend with in the dust from smoke-stacks. Two years back, he designed a Portland cement works; and they were troubled exceedingly by the nuisance of dust. Indeed, he had three actions at law pending against him now. They had overcome the difficulty very easily. They sucked up the hot air through a flue; and they took away a vast amount of "slurry" lime, while at the same time a great deal escaped with the steam through the opening at the top. They put above that a little box with a spray at the top; and they pumped up water and washed down the dust to the bottom, where they removed it by a worm. This might be tried with advantage; and he should be only too pleased to furnish them with the drawings of such an apparatus. There was another matter he wished to mention, and that was the ultimate cost of water gas into the holder. He had never been able to pin a water-gas man to the costs of labour and purification into the holder. It was usually put down at 1s. 6d. to 1s. 9d. per 1000 cubic feet. He would ask what was the normal cost of water gas into the holder?

Mr. J. L. CHAPMAN (Harrow) said he would like to state, with reference to the apparatus mentioned by the President for removing dust from cement works, that an almost identical type of apparatus was in use in the gas-works at Plymouth.

The PRESIDENT said it was a very simple apparatus.

Mr. T. S. LACEY (London) asked how much air Mr. Botley used to spray the oil, because air was hardly a suitable agent for the purpose if it was employed in any large quantity. If 1 or 2 per cent. were used, it might affect the results rather seriously. He thought it was necessary to be very careful in using figures for candles per gallon, and so forth, where there was no standard for testing these things. It was not always wise to take these candle values as £ s. d. When it came to 5 or 6 per cent. it was beyond their present system of analysis to say one could get 6·4 and another 6·5. No one could determine these figures to 1 or 2 per cent. He supposed each person tested gas in the way he thought best.

The PRESIDENT said he would like to ask Mr. Botley what was the limit of the mixture of water gas with coal gas, so as to be used for cooking purposes with their burners. Was there a limit to the matter? It was a most interesting paper; and those who, like himself, were coquetting with this system, would take it and study it with a great deal of pleasure. They were much obliged to Mr. Botley for placing his experiences at their disposal.

Mr. BOTLEY, in reply, said there were one or two points which had occurred to him where the paper had probably been misleading. In regard to testing, he thought there was a very great deal in that. Personally speaking, he had not a satisfactory standard. He had used three standards. He had also lately had occasion to make a large number of tests of two different kinds of candle; and he found the difference between one make and another to be from 1 to 1¼ candles. This was the result of 104 tests. It was therefore only fair to assume that the other gentlemen who had criticized had taken tests which were not on all-fours with his. With reference to the results, he was sorry that his

friend Mr. Brown who used to be at Hastings did not bear him out. A table was made out to April, 1897. The returns were not taken so carefully then as now. They got 5½ candles as recorded; now they got 6½. This was all the evidence they had to go on; and he could only judge by his own results. He tried to improve them; and he meant to do as well as anyone else, if he possibly could. He thought until they had a standard method of testing, it was difficult to compare the various plants. In the paper, he had given a full list of the things which would affect the question. The first they came to was the size of the plant. Everyone who had spoken was working with a larger plant than he was. This handicapped him, he was sure. One gentleman said he was making more per run than he was; but the velocity through the set might account for that. At Hastings they used their apparatus simply and solely for enrichment. So far as he was concerned, as he had said, the results were so much better than they had been used to that he was not disappointed. He did not know the details of everybody else's work. The lists very accurately represented their results at Hastings; and unfortunately they did not seem at present to be doing so well as other people. Some of the gentlemen who had criticized the down-take pipe had misunderstood him entirely. They opened this pipe, and cleaned it out; and they collected a bushel of carbon once in every three weeks. In this pipe, they had an oil-heater coil; and it was true this occupied a large portion of the pipe. They took the scale off to clear the pipe; but he denied that it was lamp-black that they took off. A gentleman said he was working at too low a heat, and that it was not what it should be. Another gentleman said he was working too high; but his heats were much about the same as those of Mr. Helps.

Mr. Helps remarked that that was so.

Mr. Botley said, as regarded the point of eliminating the sulphuretted hydrogen, they found it was very much better to eliminate the carbonic acid as far as they possibly could. He admitted that the point as to separation in the paper was not satisfactory. He was constantly experimenting now, as a suggestion had been given him to put in a coil to evaporate some of the water. He hoped to convert all the tar they made into carbon and gas. As to the limit of mixture of water gas with coal gas, which the President had mentioned, this was a matter of wide diversity of opinion. Personally, he preferred to supply coal gas for industrial and cooking purposes. He might be wrong; very likely he was. They mixed up to one-third of carburetted water gas, making the illuminating power 16 candles. He certainly did not care for carburetted water gas for industrial purposes. It might be ignorance on his part.

The President asked if he could put that quantity in without re-adjusting the burners.

Mr. Botley said he would not like to say; but he believed Mr. Broadberry could pass in 50 per cent. without any difficulty.

Mr. Broadberry remarked that they had to adjust the governor burners.

Mr. Botley (continuing) said the President had asked a question as regarded cost into the holder, which included labour, repairs and maintenance, manufacture, and purification. For labour only, the average for the year was 1·65d. per 1000 cubic feet. Material (oil and fuel, but not lime for purification) came to 14·5d.—making a total of 16·15d.

The President pointed out that this was without lime; and lime was an expensive thing.

Mr. Botley said he had had a good deal of practice with gas-engines; and he had found that, as a rule, it required more mixed gas for a given result than coal gas. They had, of course, to bear in mind that it was heavier, and the velocity through an aperture in a given time was more sluggish. It was only his impression—he had not had time to investigate the point. As regarded using air, they had employed 2 per cent. of it in the atomizer; but they were now going to try compressed gas. Referring to high-flash oil, the circumstances compared with the ordinary injection of oil were rather different. They did not have a closed system, but put their oil into a cylinder direct from the pumps. They had a mysterious mishap, which had perhaps made them over-cautious in the matter. If there was any other information required, he should be only too happy to endeavour to tell the members what he believed to be correct in the matter.

NOTES.

Royal Society Novelties.

The first Royal Society conversazione is an occasion for the display, under the most favourable auspices, of the scientific novelties of the year. This meeting, which took place on the 3rd inst., was signalized by the appearance of several remarkable new pieces of apparatus. Mr. Swinburne showed samples of the Nernst electric lamp in its newest form, as well as of the oldest pattern. The new lamps are described as extremely neat. They are rated to take 1·5 watts per candle, which increases to 1·65 watts after about 500 hours, when the consumption becomes constant for the remainder of the life of the lamp. This is of practically limitless duration, if it is truly reported that a life of 1700 hours has been obtained, and even then the lamp was not worn out. The temperature at which the Nernst light is produced approaches 3400° C.; whereas it is stated to be impracticable to work a carbon filament at much above 2700° C. The action of the lamp is started by heating the rod to a temperature of 635° C., which must be attained before it becomes a conductor of electricity. This is effected by a platinum wire resistance, which, when it has accomplished its object, is automatically cut out of the circuit by means of a short-circuiting device worked by a solenoid. Professor Callendar's exhibit included some recording pyrometers. He had a platinum pyrometer which, in addition to recording the temperature, will regulate the temperature of a furnace within one degree, at 1000° C. Sir William Crookes exhibited some photographs of a group of lines high up in the ultra-violet region of the spectrum, characteristic of a newly separated element found in association with yttrium, and to which the name of Victorium has already been given.

The Coal Resources of Great Britain.

According to Professor Hull, F.R S., the following summary is probably very near the true statement of the approximate quantity of workable coal which will remain unworked at the close of the present century down to a depth of 4000 feet below the surface, which is the probable utmost limit of depth at which it will be practicable to work coal. The resources exist in six large coal fields in England and Scotland, and a small quantity in Ireland, *plus* some small addition due to an extension of the coal measures between Dover and Bath. In this estimate, no seams less thick than 2 feet are included. (1) The Midlands, extending into the counties of York, Derby, Nottingham, Stafford, Leicester, and Warwick. From this region, house, manufacturing, gas, and steam coals are obtained. Quantity remaining, 35,000 million tons. (2) The Great Northern field, extending over portions of the counties of Northumberland, Durham, and Cumberland. House and gas coals of the best quality, and steam and manufacturing coals. Quantity, 6000 million tons. (3) The North-Western, comprising Lancashire, East Cheshire, &c. House, gas, and manufacturing coals. Quantity, 11,000 million tons. (4) Western group, comprising Bristol, Somerset, and Forest of Dean. House and second-class steam coals chiefly. Quantity, 2000 million tons. (5) Welsh, including Monmouthshire, Denbigh, and Flint. Steam, house, gas, and manufacturing coals. Quantity, 20,000 million tons. (6) The Scotch, from Ardrossan to the Firth of Forth. Gas, steam, manufacturing, smelting, and smith's coals. Quantity, 8000 million tons. (7) The Irish coal fields are taken as containing 155 million tons. This makes the available coal resources of the United Kingdom in the year 1900 about 82,000 million tons.

American Steel and Iron.

As so much has been written and said concerning the quality of American steel bridge and similar construction, the following particulars may be of interest, as showing the character of the specifications to which the Pencoyd Iron-Works, which are building the Atbara railway bridge, are accustomed to work. The Niagara Falls and Clifton arched bridge was built to replace the highway suspension bridge, and has a span of 840 feet. It was designed by Mr. L. L. Buck, of New York. The main arch consists of two parabolic braced ribs, with riveted connections, about 26 feet in normal depth, provided with ample stiff lateral bracing of latticed diagonal struts. The steel castings were made of open-hearth steel, of 0·15 to 0·16 carbon, made from stock containing not more than 0·04 per cent. of phosphorus. The steel for the pins has an ultimate tensile strength of 65,000 to 75,000 lbs. per square inch. The elastic limit is not less than 35,000 lbs. per square inch. The steel for plates and shapes is medium open-hearth steel of a grade to show an ultimate tensile strength of from 60,000 to 65,000 lbs., and an elastic limit of 33,000 lbs. When pulled in the testing machine, it had to show an elongation of at least 20 per cent. of the original length of 8 inches. It had to be capable of bending cold 180° about an inner diameter equal to the thickness of the plate, without cracking. When broken it had to show a fine silky texture of bluish-grey colour, free from brilliant or dark-coloured specks. The plates were rolled from billets at least 16 times thicker than the finished sheet. The wrought iron had a tensile strength of at least 50,000 lbs. and an elastic limit of not less than 26,000 per square inch. Machine riveting was prescribed wherever practicable. All holes were reamed after punching.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1315.)

THE Stock Exchange had a more genial time last week than it had in the week before. The disturbing factors quieted down; and the general tendency was favourable. Prices in nearly all the chief departments improved; and there was more activity and life about the business. Transactions would have been heavier, but for the settlement, which was on a scale to engross a large share of attention. But, big as it was, it gave rise to no difficulty in adjustment. The Money Market was so abundantly supplied as to be quite unaffected by the Stock Exchange requirements; and discount rates are decidedly easier. Business in the Gas Market was only moderate; and it was for the most part restricted to a very few undertakings. It has been rather noticeable lately how little has been done in some of the largest and choicest issues; while some of the not so well-known undertakings have come into unusual prominence. The general tendency was steady, though there was one conspicuous exception. Very few changes were effected in quotations; and these were only slight in degree. In Gaslight issues, the ordinary stock was moderately dealt in daily, and was at first fairly steady. It was then depressed by a rumour that its Capital Bill would be hung up until the Committee now sitting had made their report upon the Company's management and charges. The third reading of the Capital Bill on Thursday removed this fear; but the stock did not make much recovery by the close. The secured issues were not very strong either. South Metropolitan was very quiet, and was inclined to droop, though it did not actually fall. Hardly anything was marked in Commercials; but the old stock was put up a couple of points, bringing it more into line with the price of the new. The Suburban and Provincial Companies were about as quiet as they well could be, short of actual stagnation; and their prices were unchanged. The Continental Companies continued to show a good front; and Imperial pushed up another point. Among the remoter undertakings, River Plate was conspicuous for its activity and firmness; but neither it nor any other made any change in price. The Water Companies had their usual share of quiet business. Variations were few, and for the most part unimportant; but Kent had a smart rise.

The daily operations were: The Gas Market did not display much activity at the opening; but it was steady, and quotations held unchanged. In Water, Kent rose 5. Transactions were even lighter on Tuesday; and prices taken all round were poor, but there was no actual fall. On Wednesday, most of the business done was in Gaslight ordinary, which was weak, and receded 1; but Commercial old improved 2, and Imperial Continental 1. Thursday offered no remarkable feature in Gas, prices remaining unchanged. In Water, West Middlesex 4½ per cent. debenture fell 2. On Friday and Saturday, business remained at about the same level. Prices were generally steady; and all quotations closed without any further alteration.

ELECTRIC LIGHTING MEMORANDA.

The Electric Lighting Clauses Bill—The Affairs of the City of London Company—The Brighton Corporation Electric Lighting Undertaking.

THE Electric Lighting (Clauses) Bill has been printed. In the prefatory memorandum explaining its object, it is stated that the Provisional Orders granted by the Board of Trade under the Electric Lighting Acts with few exceptions follow the same model form; so that these provisions may well be incorporated in every Order, in the same way as the various "Clauses" Acts, without reprinting them all in each case. For this purpose the provisions of the model forms are placed in a Schedule to the Bill; and the enacting part of the Bill incorporates them in every Electric Light Provisional Order, subject to the variations and exceptions contained in the Order itself. Thus the reprinting of an immense quantity of absolutely identical matter will be saved every year. This is no trifle, for the clauses are 84 in number, and fill 37 pages. An Appendix to the Bill specifies the incorporated provisions of the Gas-Works Clauses Acts, 1847 and 1871, and reproduces them. These appropriated clauses deal with the breaking up of streets. It is well that it should be generally known that undertakers of electricity supply under a Provisional Order have exactly the same powers for breaking up the streets—neither more nor less than those conferred by the statute upon gas undertakers. In the construction of these clauses, "gas" is to be read as if it meant "electricity;" and "pipe" as if it meant "electric line." It would seem to follow from this that electricity supply undertakers cannot lay pipes, as such, for the conveyance through the streets of water or anything else. Certain sections of the Gas-Works Clauses Act, 1871, are also incorporated. Among these are the clauses forbidding the requirement of incoming tenants to pay arrears of rental left by the previous occupier.

The accounts of the City of London Electric Lighting Company are analyzed in the current issue of the "Electrician;" and our contemporary is very pleased with itself for being able to give this information. And justly so; for we believe the big undertaking which has been accused of having a questionable paternity has not hitherto been willing to publish more data relating to its business than the Board of Trade returns require. Still, the Company are coy as regards confessing how much electricity they generate, for comparison with the quantity accounted for. The capital expended up to the end of last year—which was the seventh year of working—amounted to £1,374,689, which works out to the "very average" rate of £118 per kilowatt capacity of the generating plant installed. It may be agreed that, as central stations go, this is not an exceptional capital burden; but we venture to think that it is extravagantly high for an undertaking of this magnitude. There are very few Companies that could be properly compared with the City of London concern, with its revenue of £171,000 a year, or thereabouts. One cannot help wondering how much of this is money out of the Gas Company's pocket. The Company have had to come down very considerably in their charges for private lighting; but still they get within a small fraction of 6d. per unit sold, which is high for the City. On the other hand, their working expenses are heavy; the unit costing the Company over 3d. to produce. As our contemporary remarks, it is difficult to lay the finger upon any item that can be said to be abnormally high; but that is always the case in such circumstances. The broad result remains that electricity in the City is dear. The Company allege that the unprofitable public lighting contracts are partly to blame for this; but the revenue from public lighting is only £13,000 a year, to £150,761 for the private lighting, exclusive of meter-rents. It has never been shown that the public lighting contracts are a source of actual loss to the Company; and at the rate of £26 per arc lamp per annum, this cannot be the case. The Company will probably have to forego the hope of ever paying a big dividend; but even if the Directors limit themselves to 5 per cent. on the ordinary capital, it may be doubted if the public will be content.

The Brighton Corporation electricity supply undertaking has arrived at the proud position of being regarded as a model establishment of the kind. Chiefly has this reputation been earned by the ingenuity displayed in the matter of pricing the current by the Engineer in charge (Mr. Arthur Wright). The "Brighton" system of differential prices is too familiar to need description here; but it may not be superfluous to remark that nowhere else has the system been so thoroughly carried out. The accounts of the Brighton undertaking are analyzed in the "Electrician," side by side with those of the City of London Company. Hence the comparison is a very glaring one, in many respects. But it is hardly necessary to remark that the two undertakings are not those that would be chosen for this ordeal of comparison "at a glance" by anyone desirous of applying a fair standard of excellence to the measurement of either, on the merits. The Brighton electric lighting undertaking had to make headway against one of the best services of gas anywhere to be found. It is not too much to say that when Mr. Arthur Wright took the concern in hand, something of the nature of a desperate remedy was needed to grapple with the straits towards which the Corporation's venture was drifting. He found it in offering a striking reduction in price for current continuously used. We are not going to discuss the merits of the system on the present occasion. Suffice it to say that, as from the beginning of 1898, the extreme course has been adopted of dropping the charge for current taken for all lighting from 7d. per unit for the first hour, to 1½d. per unit for the remainder of the day's demand. This is testing the principle to extremity—almost, one might say in engineering parlance, to the breaking point. It works out to an average revenue of 3·429d. per unit; while the return of units sold per 8-candle lamp capacity run up to 26·5. Of course, with business working out to this scale, and a capital outlay down to £74 per kilowatt capacity, the Brighton undertaking pays. The cost of producing the unit here is only 1·68d.; and this is another potent influence. Not all the dodging of the tariff in the world would make the business profitable unless the works were well and economically managed. One thing naturally reacts upon another; and in the event, Brighton shows a working profit of 8·57 per cent. on the mean capital expenditure for the year. The Corporation help themselves to £2000 a year for the district rate, by way of gratifying the ratepayers; but this is all the town gets directly out of a venture that locks up about £200,000 of capital. Still, the balance-sheet is clear, which is more than can be said for most examples of municipalized electric lighting. An allowance is made for depreciation—£864 for the year—and all the capital charges are provided for. Brighton is to be congratulated on the result, but more especially in possessing in Mr. Wright an Electrical Engineer who can make electricity cheaply in one of the dearest situations for a power factory to be found along the South Coast.

The *agenda* for the meeting of the London County Council to-day contains a report by the Public Control Committee recommending increased remuneration to the Gas Examiners on account of the additional work which will devolve upon them in testing the gas under the new regulations of the Metropolitan Gas Referees. The proposed increases range from £30 down to £5; and the relieving examiners are to have 10s. instead of 7s. a day.

TECHNICAL EDUCATION.

THAT section of the Presidential Address to the Institution of Gas Engineers which was devoted to "technical education" and to which what was, of necessity, a cursory reference was made in our review of the proceedings last week, deserves, and will we trust receive, the serious attention of all who are responsible for, or are interested in, the management of gas undertakings in this country.

The President first dealt with the subject in its national aspect; and it is rather to the commercial community in general that he has addressed his warning (which comes with special force and authority from one who speaks from his own personal observation and knowledge) against the danger of our under-estimating the highly-trained forces that are being directed against our trade supremacy. That supremacy, he warns us, is in peril of being wrested from this country by "industrial nations, which, forty years ago, were only agricultural," but which are to-day "fighting us with a deadly commercial rivalry," and are seeking to "challenge us for intellectual supremacy at every available spot on this globe." To the gas industry, which can only be indirectly affected by any foreign competition, Mr. Marshall holds up the Continental gas engineer as a model to be profitably studied, if not imitated, rather than as a rival to be feared. And his description—none the less telling by reason of its humorous exaggeration—of the highly-trained scientist who is being turned out by the Universities and Colleges of Germany for service in any and every branch of practical business, may well give cause for searchings of heart in the profession to which Mr. Marshall was addressing himself. How many of our gas engineers could be said to rank as "specialists," or how many foremen (rightly referred to as the "backbones of the profession") have, when appointed, even an ounce—let alone a pound—of the theory of "gas-making, applied mechanics, or the use of steam," or possess a "general knowledge of materials"?

The President's indictment of the engineering profession in this country consisted of two somewhat inconsistent counts. But we take it that this apparent inconsistency was due to the first being of general, and the second of particular, application. Mr. Marshall began by expressing his conviction that we lag behind our rivals in the matter of higher theoretical scientific training, not because we lack institutions for providing this training, but because we make so little use of those we have; and he then proceeded to show what institutions Germany possesses that we do not, and to appeal to the wealthy gas industry in this country to found and support adequate training colleges and laboratories for students in the profession. We have already expressed our opinion as to the amount of success with which the appeal is likely to meet, and have indicated the direction in which we think action might well be taken. We have now more particularly to consider the causes of the undoubted failure of our student engineers to avail themselves of such opportunities for specialized scientific training as are presented by the institutions we already possess.

What, then, is the cause of the failure, so far as the profession of gas engineering is concerned? We think the answer will be found, mainly, in the economic law that, so far as some commodities are concerned, a demand is necessary for the creation of a supply. So long as the standard of qualification required by many, and not the least important, companies, not only in foremen and engineers' assistants, but even in the engineers themselves, is maintained at so low a level as that at which it unfortunately stands to-day, so long will the opportunities of acquiring the special and varied scientific knowledge which is indispensable for the complete equipment of a gas engineer, be altogether neglected.

We need not here repeat the remarks on the subject that we made—in the same issue of the "JOURNAL" as contained the text of Mr. Marshall's address—when commenting upon the City and Guilds Examination in "Gas Manufacture," to which examination we are glad to see that the President referred as having "done much—very much—to increase the attractions of gas engineering, and to raise it from a mere rule-of-thumb profession to the place it should, and eventually must, occupy among the higher branches of engineering and chemical industry." But we must emphatically say that, until the idea which still survives in many quarters—that the position of gas engineer's assistant was created in order to provide employment for the relations and friends of the head officials of a company (regardless of previous training or experience), is definitely abandoned—and it becomes generally known that no candidate need apply for such a post who cannot furnish evidence of special scientific and practical knowledge, it is useless to expect that men will devote money and years to the acquirement of such specialized attainments, unless urged thereto by the united forces of necessity, genius, and ambition. "Patronage" and "influence" had to be superseded by competitive examinations before the Public Service could be brought to its present state of efficiency; and the same process will have to take place before the profession of gas engineering can be raised to the higher level of scientific skill and research which the departure of the comfortable days of no electric light competition has rendered imperative.

Mr. Corbet Woodall has bewailed the fact that electricity is "attracting a higher-toned" (we should have preferred to say "higher trained") "and better class of men" than gas. He can do much to remedy this state of things, if he will but use his influence with the Companies in whose management he has a voice and with the profession generally, in the direction which we have indicated. There need be no dearth of high-class, scientific gas engineers. We have the raw material in abundance, and we have the means of shaping it. It only needs the demand to produce the finished article.

"AULD LICHTS"—AND NEW INVENTIONS.

THE recent mention in the "JOURNAL" of incidents of the past of the gas industry has brought us some interesting letters, among others a reference, supplied by Mr. W. Smith, of Ayr, to a well-written series of articles on "Gas" that appeared in the old "Penny Magazine" so long ago as the latter end of 1834. It is unnecessary to describe the character of this celebrated periodical, which was a great educational power in its day. Its contents were severely utilitarian; and it may be doubted if it would attract the general reader of the present time. We propose to devote a little space to reproduce what was published in this old magazine about gas, just for the sake of "old times."

It will not be surprising if in the course of this glance backwards we shall have occasion to remark some still familiar features of the industry. To begin with, the writer of the essay of 1834 had a very high opinion of the advantages derived by the public from the use of gas for public and private lighting. He says: "The appearance of this vast Metropolis at night is now very different from that which was afforded within the memory of perhaps one half of those persons who frequent its streets. The beautiful light from the numerous lamps and well lit shop windows renders a walk by night as safe and as agreeable as by day, and almost blots from memory the dingy illuminations of only twenty years ago." As compared with the older means of street lighting, the writer very justly declares that "the introduction of gas was a leap in the march of improvement far beyond any that had been previously made or hoped for." We are not accustomed to think of the lighting of London sixty-five years ago as exhibiting a particularly brilliant effect; and it is quite refreshing to hear on contemporary authority that the gas lighting of those days could be fairly described as "beautiful." Of course, we think this is the proper word for it now; but our feeling of satisfaction in this regard is evidently no keener than that experienced by Londoners living in the days when "Sailor William" was King.

In 1834, it was recorded that the Chartered Gas Company of London had tripled their output during the previous ten years; and the annual consumption of gas coal by all the Metropolitan Companies was estimated at 200,000 chaldrons. The Companies were credited with distributing "through nearly 600 miles of pipe the enormous quantity of 7 million cubic feet of gas every twenty-four hours, on an average of the whole year, giving a light equal to what would be obtained from 300,000 lbs. of candles." The country at large was equally well served in this respect; it being proudly stated that "there is hardly a single provincial town of any importance which is not provided with an efficient gas establishment." The technical description of gas manufacture, which followed these general observations, is exceedingly well done. In the second article, published in the number for Nov. 1, 1834, there is a critical account of gas-retorts which might have been prepared for the Coze patent litigation. The development of the gas-retort from the original pot form of Murdoch to the ⌂ shape is succinctly traced. The quality of the matter may be appreciated from the following extract: "As it was ascertained by many experiments that where the production of gas was rapid its quality was better, and the quantity from the same measure of coal greater than when obtained slowly, it became evident that the preferable mode was to have the retort as small as convenient; but as a limit on this side was necessary, in consequence of the expense of frequently filling and emptying when very small, it was found, upon the whole, most convenient to use none smaller than sufficient to hold two bushels of coal." The truth of the matter could not be more clearly apprehended, nor more simply told.

With regard to the purification of the gas, the reader is informed that the raw product of the retorts is "far from being the fine and invisible air used in lighting the shops and streets of London." The author goes on to describe the wet lime process of purification, the discovery of which he ascribes to Dr. Henry, of Manchester, and remarks that "to this day no better means have been discovered." By way of illustrating the degree of perfection to which this process of gas purification had been carried, it is stated that "the most impure gas may be purified by a quantity of lime equal in weight to a tenth of the coal from which it was produced; while for better coals one-third of that quantity will be sufficient." No mention of separate washing or scrubbing the gas appears in this account; the foul gas passing directly from the hydraulic main to pipe condensers, and thence into the circular wet-lime boxes, which were thus "contrived a double debt to pay." Curiously enough, separate washing of the foul gas in water, in a kind of Coffey still, is described as an early arrangement that had been discarded. Next to the purifiers came the station meter, which was already perfect, "tell-tale" included. Consumers' meters, however, were not at this period generally used in London, "although it would seem they

must be advantageous both to the consumer and manufacturer, as the former would not then be compelled to pay for more than he used, and the latter would not be cheated by unprincipled persons, who surreptitiously burn more than they contract for. Gas companies, of course, while liable to this species of imposition, are forced to average their charges accordingly; but the honest consumer is thereby compelled to pay a higher price."

Coming to the storage of gas, the writer points out that the word "gasometer" can only be properly applied to a gasholder which is also a gas-measuring vessel. Where there is no station meter, therefore, and the gasholder measures as well as stores up the gas as made, this vessel is a "gasometer." A diagrammatic figure of a counterbalanced holder is given, which only shows guide rollers at the top of the tank, not on the holder itself, which is hung up by the centre of the flat crown. The writer was much exercised in mind over the huge dimensions and unsightliness of gasholders. Some of them, he remarks, almost with a groan, are of "enormous size"—measuring 60 feet in diameter—and he wishes they could be improved upon. Clegg's collapsible holder of 1817 is mentioned, with an admission that it was a failure; while another invention called "the revolving gasholder" had also fallen into oblivion. Clegg's governor, as improved by Crossley, is described and illustrated; but its operation is criticized as not altogether answering the end proposed. The night pressure had to be turned on by valve men, whose proceedings were guided by a pressure-register such as is still in use in governor houses. This instrument was first used at the Chartered Company's works in 1824.

Mains and services are particularly described. The former ranged in size from the 18-inch trunk main; and the latter might be diminished to "the small copper pipe which supplies a single light to a show window." The burners used were of different shapes. The "argand" burner was a cylindrical ring with ten or twelve holes of one-fortieth or one-sixtieth of an inch in diameter. "The 'cockspur' is a round head with three small holes, forming jets of light like a cock's foot. The 'fan' is a spreading semicircle of small jets, and the 'bat's-wing' a thin sheet of gas, produced, not by passing through holes, as in other burners, but through a narrow slit sawed half-way through a hollow globe." By such means was the brilliant and beautiful illumination of London produced. It must be remembered, however, that all such impressions are matters of comparison. The fact was that the gas-flame was the longest and brightest producible by any known means. It is recorded that the utmost illuminating power producible with the argand burner as described was equal to that of ten mould candles, when the consumption was at the rate of 3·10 cubic feet of gas per hour. More gas only made the flame smoke.

The series of articles concludes with an account of oil gas, the manufacture of which was proposed by Dr. Henry so long ago as 1805. The writer gives a sketch of a primitive oil gas retort, which need not be reproduced, as it consisted simply of a small horizontal iron cylinder, having a luted lid and two pipe connections—the oil supply pipe in front and the gas ascension-pipe at the back. A peculiarity of the latter was that *it was brought forward and sealed in the oil-service cistern from which the retort was fed*, with the object of entrapping and working over again any condensible oily vapour. The retort was partly filled with pieces of coke or brick, to provide sufficient surface for carbonizing the oil. The kind of oil used is not mentioned. It appears, from the writer's remarks on the comparative advantages of coal and oil gas, that there was just as much juggling with the burners and rates of consumption proper for the two kinds of gas in his day, when it was a question of striking the balance of illuminating value, as in these times of acetylene exploiters. The author now under notice, however, makes the very modest claim for oil gas that it had twice the illuminating power of coal gas. Even so, it could not hold its own with the latter, commercially. For a coal-gas works making 50,000 cubic feet per day, the estimated prime cost of the gas was 11s. per 1000 cubic feet; whereas oil gas would cost 35s. per 1000 cubic feet. Notwithstanding this great difference of cost, however, the author points out that where gas is only required to be made on a small scale, the simplicity and snugness of the apparatus, and the cleanliness of the operation, give oil gas the preference. It is remarkable how completely this able writer's views have been justified in this respect.

It sounds strangely like an echo of recent proceedings to hear that, in 1823, an agitation against coal gas on account of the alleged dangers attending its use, was carried to the point of the holding of a Parliamentary Inquiry. Sir William Congreve, the Government Inspector of gas and other works, was a great partizan of oil gas; and he drew up a strongly alarmist report on the hazardous character of coal gas. The wisdom of Parliament, however, was greater than that of the experts; and the Committee came to the conclusion that there was very little cause for apprehension, and no necessity for legislative interference. Our friend of the "Penny Magazine" was indeed a little over-confident on this head. He says: "The only danger to the public appears likely to arise from the escape of gas in confined places, such as cellars, cupboards, and enclosed shop-counters, through which a pipe might pass. A flaw in such a pipe might, in a few days, emit gas enough to form a dangerous mixture; and a candle incautiously introduced might produce an explosion. Careful persons will not allow pipes to be laid in such situations, or, if that cannot be dispensed with, they will not bring a candle into them without due precautions." Alas! the years that have flown since these words were written, by a hand long since still, have not sufficed for the elimination of the particular kind of fool who looks for an escape of gas with a light. He remains always with us, like the other idiot who points guns at people "in fun." Much of the magazine writer's information was derived, as he owns, from Matthews's "Compendium of Gas Lighting." He appears to have known what he was writing about, however, from his own technical equipment; for it is hard to believe he was not intimately connected with the engineering staff of a London Gas Company.

Before leaving this old magazine, we wish to refer to an article that appeared in No. 148, dated July 26, 1834, in which different methods of procuring fire are described. At this period the flint and steel, with their accompaniments the tinder-box and the brimstone match, were not only the customary agents for "striking a light;" but so well-informed a person as the contributor to the "Penny Magazine" so little expected anything better that he declared that "from its superior cheapness, the tinder-box will always keep its place in domestic use." Time, however, is money; and the phosphorus match was destined to upset all such ideas. Although there were no friction matches in 1834, there was a very elegant piece of apparatus on sale, which produced a light by the action of platinum upon hydrogen. Verily, the ways of material civilization and progress are devious. These old periodicals enable us to see our predecessors hopefully chasing all sorts of rainbow fancies, while the ways to solid gain lay open before them and were unheeded. Why, one of the methods of procuring fire described in 1834 was a so-called "phosphorus box." It consisted of a corked bottle, containing a bit of phosphorus, and a few common (sulphur) matches. "When a light was wanted, one of the matches was pressed against the phosphorus, so as to detach a minute particle, and then rubbed quickly against the cork. The match would be lighted by this plan in a few seconds." Nobody saw the apparently obvious next step, of putting the phosphorus permanently upon the tip of the match. Knowing so much as he did, the describer of the "phosphorus box" said that "it remains for future ingenuity to discover some plan which shall unite cheapness with the other requisite"—of convenience. Such a view of the purblindness of mankind tends to humiliate ourselves; for who knows what gifts of the gods we are kicking aside every step we take?

INCANDESCENT GAS LIGHTING.

FEW of our readers will, we imagine, be disposed to contest the statement that one of the most notable events in the history of artificial illumination in the latter half of the present century has been the extraordinary development of the incandescent system of gas lighting in its final decade. Less than ten years ago, a distinguished Continental gas engineer, when on a visit to the Metropolis, inquired of the writer where he could see any installations of the Welsbach system, which was, he said, in use in nearly every café in Vienna. At that time he could only be referred to the depôts of the "A.B.C." Company; whereas now the questioner would have some difficulty in finding a thoroughfare of any importance which could not show him incandescent gas-burners in use for either indoor or outdoor lighting. In the Provinces, as in the Metropolis, the system has been extensively adopted. The result has been that gas engineers and managers, as a general rule, have been too busily occupied in satisfying the requirements of their customers in the way of fittings and materials for a trial of the system, to devote much time to the study of its origin. They have welcomed it as a weapon with which to fight their opponents in the field of artificial illumination, and have left to the men of science the task of investigating the process by which that weapon has been produced, and enlightening them thereon from the platform or in the Press. Conspicuous among these stands the gentleman whose recent brilliant lecture to the Institution of Gas Engineers (as given in the "JOURNAL" last week) was a source of pleasure and instruction to all who heard it; while another scientist—M. Truchot—has lately given to the world the results of his researches on the subject of incandescent gas lighting.*

In his opening chapter, M. Truchot deals with the production of light by incandescence. He defines light and its properties, and quotes Professor Lewes's dictum that the lighting power of the hydrocarbons is chiefly due to the localization of the heat of formation of the acetylene resulting from the decomposition of the ethylene existing in the gas; the temperature of the flame due to combustion being insufficient to produce the incandescence of the particles of carbon therein. He next passes on to treat of the spectroscopy of the incandescent gas-light, and to show that, according to Von Mützel, its spectrum is poorer in red bands than that of the electric incandescent light, while in green tints it is richer. In bright blue, the two lights are about equal, but the electric light has more violet than the other. Photometry and the standards of light are next treated; and in this connection some reference is made to M. Maréchal's method of

* "L'Eclairage à Incandescence par le Gaz et les Liquides Gazéifiés." Par P. Truchot, Ingénieur-Chimiste. Paris: MM. Georges Carré et C. Naud; 1899.

determining the curves of equal lighting as applied to Welsbach burners. Diagrams are given of the curves obtained in a comparative trial of ordinary flat-flame and Welsbach burners in the Avenue de la Grande Armée, in Paris; and they show in a striking manner the advantage of using the latter appliances. This trial has been noticed in the "JOURNAL" (see Vol. LXIX., pp. 341, 350). On the subject of the photogenic capacity of a light-centre, the author points out that the higher the temperature of an incandescent body, the greater is the intensity of the light emitted. This elevated flame temperature, therefore, should be the object sought in incandescent lighting. The author closes his first chapter with an interesting review of the various hypotheses from time to time put forward on the phenomena of luminescence.

M. Truchot gives in his second chapter a succinct history of incandescent lighting by gas and gasified liquids from the time of the introduction of the Drummond light early in 1826 down to the invention of Dr. Auer in 1885. He compares the various processes, and remarks that not the least of the benefits resulting from the discovery of the light-yielding property of the rare earths has been the fillip given to the study of these earths, which previously had been little understood. This remark very naturally leads the author to the next divisions of his subject—the various minerals employed in the manufacture of incandescent mantles, and incandescent bodies in general. The method of making a mantle is explained, and the characteristics of a good one are pointed out. When used for public lighting, the author gives mantles an average life of 68 days, depending upon the placing of the burner, the method of lighting, and the skill of the lighter. The colour of the light emitted by the mantle of course varies according to the nature of the oxides used in its formation. Incandescence by coal gas and water gas is next considered, and the various ordinary and high-power burners used in this connection are described. The author discusses the merits of the Bandsept, Lecomte, Denayrouze, and St. Paul burners, all of which have been noticed from time to time in our columns. Having disposed of burners, he directs attention to the conditions necessary for good combustion, and describes the appliances in use for regulating the pressure of gas. A chapter is devoted to the subject of the lighting of incandescent burners—an operation which materially shortens the life of the mantle if improperly performed. The author considers the three systems of lighting now in use—by the ladder or rod, by condensation of the gas, and by an electric current; and he closes with a few observations on the various kinds of chimneys and globes used in connection with incandescent lighting.

The use of petroleum, petroleum spirit, alcohol, and gasified liquids for the production of incandescent lighting, is dealt with in three of the closing chapters in the book. The low price of petroleum has for some few years led to attempts to utilize it for incandescent lighting by the aid of mantles formed of the oxides; but the complex nature of the liquid has, up to now, rendered them unsuccessful. There are nevertheless something like fifty different types of petroleum incandescent lamps, some of which the author shortly describes, and refers his readers to his list of specifications for further particulars on this branch of his subject. As to incandescent lighting by alcohol, one of the advantages claimed for this system is the suppression of the bad odour and "sweating" which are inseparable from the use of mineral oils. There are four ways of leading the oil to the burner—by gasification, pressure of a spring, suction, and hydrostatic pressure. All are attended with some inconvenience; but the two last, and especially the third, are the most practicable—the fourth being of little use except for public lighting. A certain number of inventors have endeavoured to apply acetylene to incandescent lighting; but M. Truchot regards the attempt very much in the light of "gilding refined gold." He considers that acetylene of itself possesses a sufficiently high illuminating power to render unnecessary any heightening of it.

Coming to the application of incandescent lighting, the author records how the advent of the Welsbach mantle led to a revolution in both private and public lighting. In Paris, the old flat-flame burner, consuming 5 cubic feet of gas per hour, has been discarded in favour of a Welsbach burner using only 4 cubic feet; and in the trial in the Avenue de la Grande Armée, already referred to, the latter burners were found to give three times the light of the former. A few observations are made on the use of the incandescent gas system for railway carriage lighting, lighthouses, photography, and micrography. These are followed by comparisons of the system with other kinds of lighting. At the end of the book is a list of French patents taken out mainly between the years 1893 and 1897, but including others of earlier date; and this is followed by an index.

In closing this notice of M. Truchot's book, it only remains to say that the aim of the author has been to present a concise record of the progress made in incandescent gas lighting during the last few years—dealing with the subject theoretically and practically. If his work is not exhaustive, it is because finality in science or industry is not reached when the final sheets of a book dealing with any branch of it are sent to press. M. Truchot has amply illustrated his text; and the publishers have sent it out in a very presentable form. If only a little more care had been bestowed upon the spelling of some of the names, the book would have been free from a blemish which unfortunately now attaches to it.

HINTS ON SPECIFICATION WRITING.

A VERY suggestive and instructive paper on "Specifications" by Mr. F. W. Macey was recently read before the Architectural Association. The author has published a book on the subject which is held to be an authority by architects and builders; so that in all probability his contribution to the "Transactions" of the Architectural Association was "by request." We have had previous occasion to mention the excellent rule of the Association bearing upon this point. Whatever its origin, Mr. Macey's paper was worth studying as an exposition of the science of specification writing "up to date." The importance of a perfect command of this branch of professional knowledge is early brought home to the cognizance of the aspirant to gas engineering employment; and no excuse is therefore needed for an essay based upon Mr. Macey's paper. Specification writing may be dull and tedious work, compared with designing and planning; but it is something that has to be done, and done properly. All other things being equal, he is the best Engineer whose work shows the fewest and lowest "extras," and whose contracts are sought after by the class of contractors that dislikes litigation. Clear, plain drawings, and accurate, just, and adequate specifications are the essentials to professional success of this kind.

As Mr. Macey remarks, a specification may be either lengthy or curtailed, according to the particulars given upon the drawings. The engineering student should be invited to consider every order for materials to be supplied, or work to be done, in the light of a specification. It does not make any difference that the requirement is set out in a couple of lines—the thing is "specified" all the same. One soon learns how easy it is to misunderstand an order; and the lesson is one to be kept constantly in the engineer's mind. With respect to specifications proper, as prepared for the explanation of contract drawings, it is well known that some engineers favour a short specification, preferring to put as much written information as possible upon the drawings. One of the reasons admitted by Mr. Macey for this practice, which is the modern rule, is that engineers usually supply a number of detail drawings with their contract plans, which enables them to put many notes upon those sheets. Architects, on the other hand, do not usually supply many detail drawings; and they consequently find it necessary to make lengthy specifications. The difference of engineering and architectural practice here disclosed proceeds from the totally different character of the two classes of work. Engineering detail is of the very essence of the construction. If such work is "designed" at all, it is necessary to go into every minute particular as to how the parts are to be put together. Not so in ordinary building. The engineer numbers his rivets; but the carpenter does not count his nails. Besides, in general, engineering drawings and specifications appeal to fewer trades than their architectural equivalents; so that the figured drawing, showing everything needful at a glance, is nearly all that is necessary. Certainly, whatever may be the truth as regards architectural specifications, those relating to engineering constructions tend to become shorter, and to be concentrated upon description of the quality of the materials and of the incidents of execution of the contract.

As Mr. Macey remarks, the requisite information for the constructor may be conveyed, to a great extent, by either the plans or the specification. There is a debateable margin, which may be encroached upon from either side. It is easy to conceive of a set of plans, for some jobs, being so amply written up that a specification is scarcely necessary. This cannot be said of the amplest specification, which must usually be accompanied by drawings to make its application clear; excepting the case of general repairs or decorations. The exception truly "proves the rule."

Generally speaking, all necessary information should, so far as is practicable, be put into the drawings, especially the dimensions. These should be carefully figured; and the figures thoroughly checked, be it noted, by somebody who did not make the drawings to scale. The only writing, besides the dimensions, that should go upon a drawing is the names of the parts. Notes of the quality of the materials, &c., are out of place in a drawing, as these orders are for the master only. Mr. Macey gives a not superfluous hint to draughtsmen when he says "with regard to small-scale drawings, do not labour the elevations by showing every brick and slate. Working drawings will be far clearer without too many lines, and there is no need to finish them like a picture." Over-pictorial mechanical draughtsmanship is a waste of time and money. Is it unnecessary to remark that the specification should always agree with the drawings? It should be; but discrepancies will creep in, unless possible openings for error are vigilantly watched over.

Assuming that the plans are completed, and the time has arrived for writing the specification, what is the first essential for the proper performance of the task so that the written instructions shall be full enough, concise, and free from the risk of being misconstrued? Mr. Macey answers, truly, that the first consideration is complete mastery of the subject. The writer must know thoroughly well what is wanted, and also how to ensure the attainment of it. The two ideas are not by any means the same. Many an engineer and architect knows perfectly well what is wanted, without possessing a competent practical acquaintance with the best, the handiest, and the cheapest

materials and methods for carrying his plans into effect. This observation recalls much that has been heard of late of the aloofness of English civil engineers from those mercantile and industrial concerns a knowledge of which would help them to plan so as to save time and money without sacrificing efficiency. It has been complained, in short, that the English civil engineer has a way of specifying *à la carte*, without deigning to inquire what are the dishes actually ready. The former is the more lordly, and perhaps the more scientific way; but the latter is cheaper and saves time.

To the question as to the best way of obtaining the requisite knowledge, Mr. Macey replies that he only knows of two—study and observation. What he does himself is to read any works obtainable which bear upon any doubtful point; and he adds that "much useful information can sometimes be gained from trade catalogues." He might also have remarked that there is a good deal to be learnt from trade advertisements, by anyone who knows how to allow for the customary and expected "seasoning." It is good to discuss the matter on every possible occasion with any one who has any knowledge of the subject—"talking shop;" and, further, one can always keep one's eyes open, and see what is going on in the world. Mr. Macey advises that the first draft specification should be written with care and thought, not dashed off anyhow. Being fresh to the job, even so dry a matter arouses a certain amount of interest; and concentration of thought on the subject is comparatively easy. Meanwhile, doubtful points will suggest themselves, and can be marked for reference. We venture to offer the hint, upon this stage of the work, that a bound note-book, of foolscap size, is very convenient for drafting a specification. If the writing is confined to the right-hand page, the opposite page will be available for those notes and queries which are to have their effect upon the completed draft. It is preferable at this stage of composition not to attempt condensation or conciseness of expression; but rather to jot down everything that comes uppermost, leaving the task of selection to be performed later. Plenty of room on the paper is an aid to comprehensiveness of composition.

When the final form of the specification is settled, it is well to remember that this is a legal document. Experience, acquired or learnt, should indicate that pitfalls are to be fenced round. Above all things, vagueness of diction is to be shunned. In this connection Mr. Macey well observes that the wording so often seen in specifications, that certain things are to be done "all complete," or "as is required," merely cloak the designer's ignorance. He says "it is not reasonable to ask a man to estimate for something of which you yourself do not know the requirements. Consequently you either get an unfair estimate or an incomplete work, or else a squabble ensues." When there is a doubt, it is preferable to give the amount a name, provisionally, and let it work itself out in execution.

Classification of materials and parts of structures is a great help to the condensation of specifications and the avoidance of repetitions. Many of the elements of structures can usually be generalized for this purpose; as, for instance, the quality of all the wrought iron and the steel in the form of plates, bars, pins, &c. Any special features or qualities requiring description should be singled out for treatment first. Scantlings may with advantage be set out in tabular form—*i.e.*, one under the other, instead of one after another in line. It will take more paper; but that is a good fault. So much may also be said for breaking up a specification into many paragraphs, with a plentiful use of full stops. This way clearness lies.

Mr. Macey is careful to lay stress upon the wisdom and fairness to all parties, of keeping out of the specification proper, and putting into the general conditions, any requirements which may directly influence the cost of execution of the work. It is sometimes impossible to observe this distinction; but where the clauses usually devoted to setting out quality or anything applying to the same class of work in general are varied by special notifications, such as the order of execution, or anything else that may affect the estimate, attention should be drawn to the circumstance. Marginal references, the numbering of clauses, dividing the subject-matter by cross headings, and a complete index, are all essential points of a good specification for an important job. Anything, in short, which facilitates correspondence, and saves the brief and precious moments when engineer and contractor meet on the job to settle knotty points, is worth having at the price of a little extra office work.

Mr. Macey refers to the often sore point of the natural and trade meaning of common words in specifications. A leading case in point is that of the boiler which was made of "Best" iron, as specified, only for it to be discovered that there were several higher grades of iron known to the trade. Mr. Macey discourages any attempt to get behind the common and ordinary meaning of such words. He says that when one writes "best"—carefully using the small initial letter, we presume—it should be understood as signifying once for all that the word as applied to materials, articles, and workmanship "shall mean that there is no superior quality of material or finish of article in the market, and no better class of workmanship obtainable." There is an obvious danger in using such terms as "best finest," "extra best," "best best," and so forth, which may or may not have a technical signification, but do not correspond with the constructor's needs. Another caution relates to the habit specification writers get into of naming certain permissible classes of materials which do not happen to be in the market, by their once familiar names. If the engineer wants a certain make of material, and means to have it, he is within his right to specify for it; but otherwise it is preferable to state a minimum of strength or other quality, irrespective of origin. Similarly, misleading and exaggerated requirements, such as "timber free from knots," which can never be supplied, should be avoided. "We should only specify what we can get, what we mean to have, and then see that we get it."

These are words of wisdom, applicable to all kinds of contracting engineers' or builders' work. It would perhaps be too much to say positively that an engineer should never use a term (technical or otherwise) in a specification which he does not completely understand; but the margin of permissibility in such matters is a very narrow one, and it should be the care of every engineer to reduce it in his own case to the smallest expression. Where quantities are supplied, the risk of misunderstandings in this regard is materially lessened. A valuable hint was given by Mr. Macey as to the expediency of specifying for the removal of scaffolding, hoarding, shoring, temporary buildings, and all other contractor's lumber within a fixed period after the termination of the job. And where any provision for taking "prime cost" is made, the meaning of the term should be defined; as frequently engineers and contractors differ rather sharply on this point.

A NOTABLE GAS ENGINEERING FEAT IN THE CITY.

A UNIQUE piece of work in connection with gas distribution has been carried out, with marvellous success, under conditions of unparalleled difficulty, in the City portion of The Gaslight and Coke Company's system; and by the courtesy of the Governor of the Company (Colonel Makins) and the Chief Distributing Engineer (Mr. G. F. L. Foulger), we are able to lay before our readers some particulars, with plans and a reproduction of a photograph, of this exceptionally interesting engineering feat. The work involved the removal and levelling of existing huge mains, and the laying of new mains in a subway at a considerable depth, without any interruption of the gas supply. As indicated by the photograph and plan (p. 1294), the scene of operations was the open space bounded by the Bank, the Royal Exchange, and the Mansion House, with six important main thoroughfares converging upon it. A more awkward spot for, or one presenting more obstacles or difficulties to, the perfect accomplishment of a ponderous task of this kind, we venture to assert, could not be found. But the work has been finished; and for the amazingly good job which has been made of it praise is due to Mr. Foulger, to the Contractors (Messrs. John Aird and Sons), and to everyone, from the highest to the lowest, who assisted in bringing about its consummation.

This great change in the position of the mains was necessitated by the construction of the Central London Railway; the principal station of which is being built underneath the open space in front of the Royal Exchange. The large booking-office will be circuited by a passenger subway, entrance to which will be obtained from five different points. The pipe subway has been formed beneath that for passenger traffic. The sectional plan gives a good indication of its construction, and also the method adopted for connecting, by means of six shafts, the main in the subway with those in the streets radiating from this point. Before the excavation work for the station was commenced, beneath the surface of the roadway in front of the Mansion House was a perfect labyrinth of mains—in fact, Mr. Foulger says it is no exaggeration to say that mains for various purposes were, at that spot, lying as close together as the pipes of an organ. Preceding the alteration, all the gas-mains were doing active duty; and it was necessary that the whole, or nearly the whole, of them should be temporarily supported during the construction of the pipe subway. It was also requisite that the whole of the mains coming down the streets converging on to the open space should be reduced to one common level. This was accomplished by stripping them back for some distance; but the work had to be performed by short lengths at a time owing to the enormous traffic. A cross connection was then made in order to pick up the whole of the mains; the cross connection being slightly in excess of the capacity of the existing mains. Then another main slightly in excess of the capacity of the cross connection was carried down each of the shafts; a valve having previously been inserted just outside each shaft, so that, in the event of anything happening in the subway, the whole of the gas could be shut off. The descending mains were finally connected with the 30-inch main which runs completely round the subway. The mains dealt with in this way were two 24-inch ones running respectively from the Poultry and Cornhill, and three 14-inch ones from Princes Street, Threadneedle Street, and Lombard Street. It is hardly necessary to add that the whole of these mains are at one district pressure, varying, of course, during the hours of darkness or daylight.

What materially complicated the situation was the fact that the Company have a high-pressure main traversing this area; and it had to be dealt with separately and specially. This main is one of those which conveys gas from Beckton, and it runs to the valve-house at Blackfriars, which was formerly the site of the old City of London Gas-Works. The gas which this

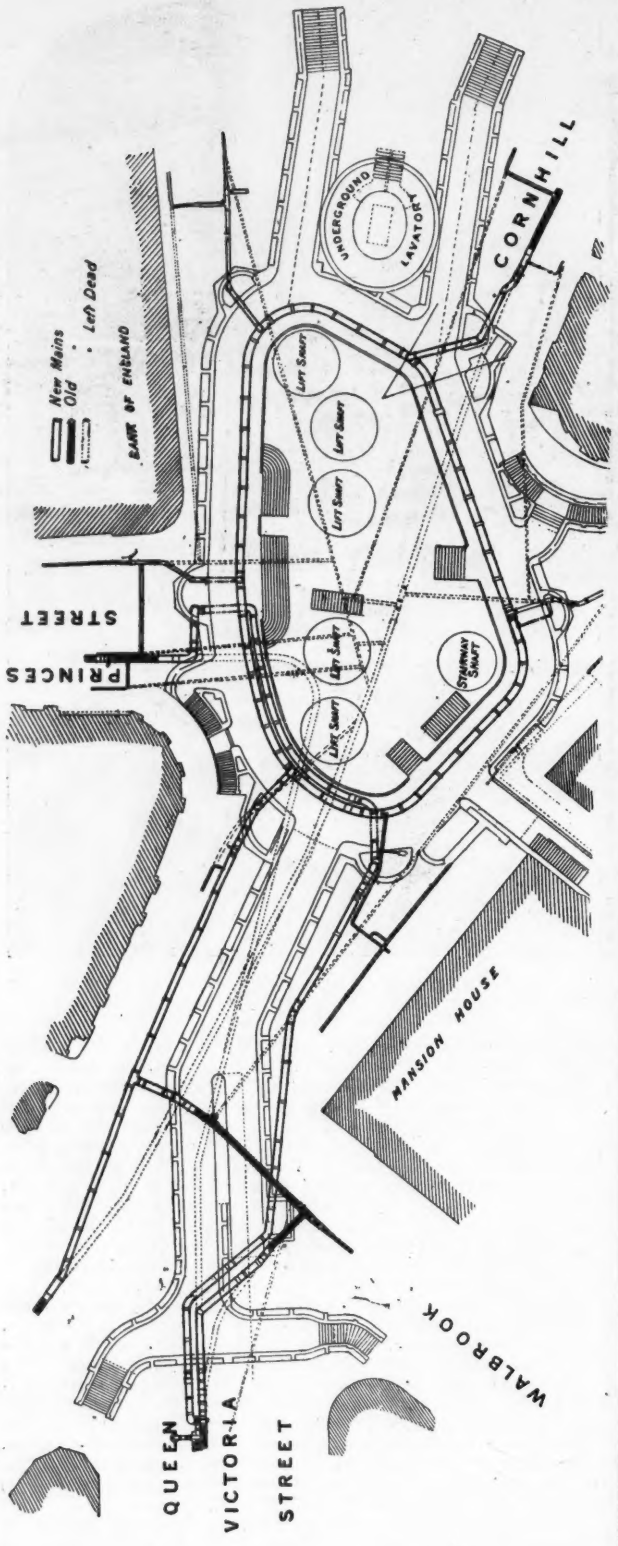
STEEL PIPES IN THE POULTRY, LOOKING EAST, TOWARDS THE ROYAL EXCHANGE.

main contains leaves Beckton at a pressure of 240·10ths; and there is no reduction in this beyond what is caused by friction in transit. It was necessary that the main, which is a 24-inch one, should be taken down one shaft in Princes Street into the subway and up another shaft in Queen Victoria Street. Looking at the plan, it is the length of main running on the inside of the 30-inch main in the subway between the two streets named. The intricacy of the work was intensified by the fact that the various mains had to be stripped back for a considerable distance in order to pick up the numerous connections, especially at the entrance to Queen Victoria Street, through which runs one of the many pipe subways which are to be found in London.

Another obstacle which materially assisted in complicating matters at the beginning of Queen Victoria Street was the staircase and passage leading to the Central London Railway and the Waterloo and City Railway Stations. The roof of the passage is at such a shallow depth that it was necessary to specially devise a method by which the gas could be taken safely across it. For this purpose, templates were obtained; and from them two riveted steel tubes were constructed to pick up the two ends of the cast-iron mains, which it was impossible to carry across. These tubes had a ring shrunk on to each end, in order to more readily connect with the cast-iron sockets, or double collars, into which they were to be inserted. The object of using steel tubes was, in the first place, to get over the difficulty in regard to depth; and, secondly, to enable them to be buried in the concrete of which the road is formed. One of these tubes contains gas at high pressure; the other, at district pressure. After leaving this spot, they both pass through the pipe subway in Queen Victoria Street. These steel tubes are shown in the photographic reproduction; and their nearness to the surface of the road is indicated by the planks which are thrown across the trench, and are resting at both ends at the ordinary level of the roadway.

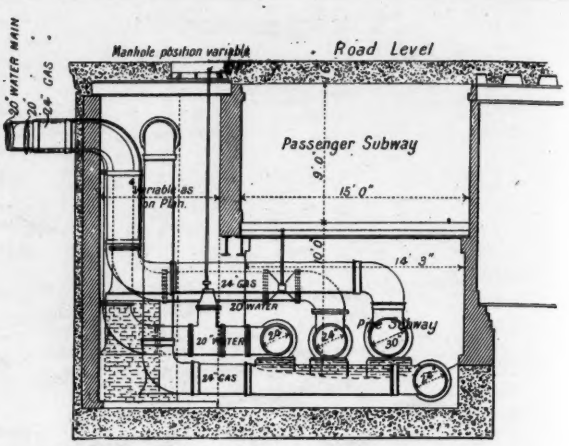
Now turning to the subway. Of course, it has not been constructed for the gas-mains alone. It also contains the water-mains of the New River Company and of the Hydraulic Power Company, together with telegraph wires, &c. As already intimated, the subway follows the line, at a lower level, of that which has been built for access, from various points, to the Bank Station. The height of the pipe subway is about 10 feet, and the width 14 ft. 3 in.; and the floor level is more than 20 feet from the surface of the road. It is only by a visit to the subway (which the writer of this article has been enabled to make by the kindness of Mr. Foulger) that the extensive character of the work can be gauged. In the first place, there is scarcely a straight pipe in the whole of the circuit of the subway; and it was necessary that templates should be taken in position from which to cast the huge mains. Each 12 feet length weighs about 2 tons; and in such a confined position, and at such a depth, these were awkward things to handle and deal with. The pipes are carried on brick piers built on concrete. The sockets are specially thick and heavy, and the joints are of the same thickness of lead all round, and perfectly solid—only one strand of yarn being used to prevent the lead running into the pipes. The joints throughout the work in the subway bear evidence to the skilful hands which have been employed upon them. They are, without exaggeration, as clean and beautifully made as one could desire on a small gas-pipe inside a dwelling-house. The ugly complication which the 24-inch high-pressure main occasioned is best realized when its situation in the subway is seen, and when it is explained that at two points it had to be carried underneath the other mains, which were already in position. The whole of the main work in the subway is completed, but the subway itself (which is lighted by incandescent electric lamps) still requires a little labour to finish it off.

The smartness with which the work was executed merits the highest praise. It was completed within six months from the date of starting, notwithstanding that a large proportion of it had to be done at night time and on Sundays, in order not to interfere with the traffic. So far as the gas-main work was concerned, the public suffered no inconvenience—indeed, it may safely be said that few knew that work of such magnitude was in progress. Of course, a great many preliminary arrangements had to be made to maintain the supply in the City, where the consumption of gas by day is almost equal to that by night—so many restaurants use gas for cooking purposes, vaults have to be supplied (in some instances at a depth of 65 feet), and the Underground Railway use gas both at the stations and in the signals. It will therefore be seen that it was of the highest importance that no lights should be extinguished during the progress of the work. Consequently, it was necessary to make arrangements in some cases miles away. For example, provision had to be made for taking in a supply of Beckton gas at the Bow Common works, in order that the usual supply from



that station should be allowed to flow into the portion of the City westward of Cornhill which is, as a rule, the boundary of the Bow Common service. It was also essential that supplies should be similarly taken from other sources so that the pressures might be adequately maintained up to the points where it was necessary to cap back the mains undergoing alteration. After the whole of the connections on the surface of the road were complete, the valves were opened in the descending shafts to the subway, and the mains were charged. The old mains were then taken out, mostly from underneath, with considerable difficulty, as beneath the surface there was a perfect forest of timber which was temporarily supporting the roadway immediately on the top of the concrete prior to the permanent roofing for the station being installed.

The pipe subway, it should be mentioned, was the suggestion of Sir Benjamin Baker, one of the Engineers for the new line;



Cross Section of Pipe and Passenger Subways.

but the method of dealing with the gas-main system originated with Mr. Foulger, and the scheme was carried out under his supervision. The fact that not a single consumer suffered—nay more, that not a single gas-jet was extinguished in consequence of this huge change under such difficult circumstances, places the work in the front rank of gas engineering achievements.

PERSONAL.

Mr. J. Walker, of the Edinburgh Gas-Works, has received the appointment of Manager to the Comrie Gas Company, in succession to Mr. W. M'George.

Mr. John O'Neill, formerly Manager of the Lochmaben Gas-Works, and son of Mr. Patrick O'Neill, the present Manager, has been appointed to a similar position with the Cumnock Gas Company.

Mr. Peter Chalmers, of Coupar Angus, has been successful in his application for the position of Manager of the Castle Douglas Gas-Works. There were some forty candidates for the post vacant by the removal of Mr. P. B. Watson to Stranraer.

Mr. Edward P. Reilly, who is now engaged as foreman at the Nine Elms station of The Gaslight and Coke Company, has been appointed Manager of the Guildford Gas-Works, in succession to Mr. E. J. Lloyd; and his duties will commence next month.

A large number of the friends and fellow-workers of Mr. A. J. Hughes, M.Inst.C.E., Chief Engineer to the Calcutta Corporation, met on Thursday, the 6th ult., in the Town Hall, to bid him farewell prior to his departure from India. The occasion was chosen to present to him a token of their esteem in the form of an address, enclosed in a silver-mounted bamboo casket, accompanied by a gold watch and chain. Among the signatories to the address were Mr. D. Coats Niven, Engineer to the Oriental Gas Company, and Mr. Arthur Peirce, Assistant-Engineer to the Corporation. In acknowledging the gifts, Mr. Hughes gave a sketch of the works he had carried out during his tenure of the position he was vacating, and thanked those who had been associated with him, especially Mr. Peirce and some others, for their loyal assistance.

At St. Nicholas Cole-Abbey Church, Queen Victoria Street, on Friday last, the marriage was celebrated between Mr. W. R. Chester, M.Inst.C.E., the Engineer and General Manager of the Nottingham Corporation Gas Undertaking, and Miss Irene Dudley Kerr, only daughter of the late Rev. E. Douglas Dudley Kerr. On Wednesday, to mark the auspicious occasion, the officials of the Gas Department presented a wedding gift to Mr. Chester. The presentation consisted of a silver tea service and ebony tray, bearing the following inscription: "Presented to Mr. and Mrs. W. R. Chester on the occasion of their marriage, by the engineering staff of the Nottingham Corporation Gas Department, May 12th, 1899." Mr. Tagg, being the oldest official, was called upon to make the presentation, which he did in well-chosen words. Mr. Chester, in responding, expressed the great pleasure he experienced in receiving the testimony of the good feeling which existed among the officials of the department towards himself, and assured them that the splendid gift was greatly appreciated, not only for its intrinsic value, but more especially as a memorial of the kindly feelings and good wishes extended to him at this particular period in his life.

We much regret that, by inadvertence, the name of Mr. J. F. Braidwood, the Superintendent of the Greenwich station of the South Metropolitan Gas Company, was omitted from the notice of the funeral of the late Mr. Frank Livesey which appeared in the "Journal" last week. Mr. Braidwood was present with his three colleagues to pay the last tribute of respect to the memory of their esteemed chief.

TECHNICAL RECORD.

INCLINED RETORTS AND NEW PROJECTS AT SMETHWICK GAS-WORKS.

During the early part of the summer last year, the Gas Committee of the Smethwick District Council decided to proceed with a scheme of gas-works extension on lines laid down by their Engineer, Mr. B. W. Smith. Owing to the rapid expansion of the district of supply, it had become imperative to augment the producing power of the works in order to meet the increasing demand for gas; and Mr. Smith, after careful consideration, decided to adopt the inclined retort system, with all the latest improvements for obtaining the highest efficiency at the lowest cost. Having drawn up a complete specification of requirements, tenders were invited, with the result that Mr. Thomas Vale, of Stourport, secured the contract for the building of the retort-house, the coal-breaker pits, and the arches, main flue, and chimney; and the tender of Messrs. W. J. Jenkins and Co., Limited, of Retford, was accepted for the whole of the machinery for breaking, elevating, conveying, and storing the coal, the building of the brickwork of the settings and producers to their own designs, the ironwork in the settings, drawing and charging floors, and roof, together with all the incidental work connected with the completion of the plant ready for operation. The house having been finished, and work in it having been in full swing about a fortnight, the members of the District Council inspected their new possession last Wednesday; and, by their courtesy, a few interested visitors were also present.

The new building (which has been erected against the end of the existing retort-house) is a neat and substantial structure. Its dimensions are 57 ft. by 56 ft., and it is 42 ft. 6 in. high from the floor-line to the inside of the shoe, with a basement 9 ft. in depth. The roof is of iron and slated, having a raised ventilator along the apex. In order to bring the new house into conformity with the existing house, the drawing-floors of both houses are on the ground level; and the generators and regenerators are placed in the basement below the ground level. The retort-bench of the inclined installation starts from the basement level, and the basement has been made of sufficient width to allow of a passage right round the bench, so that all dampers and secondary air-slides can be conveniently attended to. For the purpose of ventilation, a shaft has been built at one end of the bench, opening into the air at the ground-floor level outside the end of the house, and covered with cast-iron grids. The arrangement acts with great perfection, and renders the work of clinkering much more bearable than usual, owing to the rapid change of air, and the consequent clearing away of all steam and noxious gases. For clean and orderly arrangements, the basement leaves nothing to be desired. Certainly Mr. Smith deserves great credit for having considered the comfort of his workmen so thoroughly. The basement is covered on three sides by chequered steel plates, carried on girders; and on the drawing side a series of brick arches supported on steel girders, carried at one end on the basement wall, and at the other on the buckstays, form the floor; being pitched with blue bricks, and made water-tight from front to back.

The retort-bench consists of four arches, about 10 ft. 9 in. centres by 17 feet through, measured horizontally, each containing eight retorts 24 in. by 16 in. ⏀ at the bottom, tapering to 20 in. by 16 in. ⏀ at the top; all being set at an angle of 32°, and consequently 20 feet long on the slope. The gas passes up the ascension-pipes through anti-dip valves into a dry foul main; no hydraulic main being used. Mr. Smith, we believe, is the first Gas Engineer to use this arrangement with inclined retorts; and, we are assured, that the results amply justify his decision. The charging arrangements consist of an overhead storage hopper, of a capacity sufficient for 24 hours' supply of coal. Beneath are placed twelve measuring chambers, having an adjustment inside to determine the exact weight of the charge. The lever arrangement for manipulating the slides of the measuring chambers deserves special mention on account of its simplicity and effectiveness. By Mr. Jenkins's improved method, one lever does the whole work of either opening or closing the top or bottom slides at will; and the parts are so arranged that one door must be closed before the other is opened. By a movement of the lever from the vertical position to the right, the top slide is opened; the bottom slide being held firmly shut. To close the top slide, the lever is again brought into the vertical position. To open the bottom slide, the lever is moved from the vertical position to the left, and the top slide is then firmly shut until the bottom slide is again closed. This somewhat complicated series of actions is attained by means as simple as effective; but they cannot be more clearly explained without drawings. On leaving the measuring chambers, the coal falls into a charging-shoot; each tier of retorts being supplied by a separate shoot. A simple arrangement inside the shoot adjusts the weight of the charge put in, and ensures an even layer; but we are not at liberty to describe the means at present. However, we can bear testimony to its effectiveness, as the charges in every instance during the inspection last Wednesday came exactly to the desired points in the tops of the retorts. The charging-stage is formed of chequered cast-iron plates supported on steel girders. One excellent feature of the installation is the convenient staircases by which one can ascend with the utmost comfort from the ground level to the oiling-platform of the conveyor close to the roof. There can be no question about the superiority and convenience of this for the men, compared with the ordinary step ladders; and, inasmuch as it renders the work of supervising and oiling the apparatus quite an easy matter, there is not likely to be any laxity in this respect.

Another interesting feature of the installation is the engine-room. This is arranged in one corner of the building under the charging-stage, and partly below the ground-line. The entrance is from the outside of the retort-house; and special provision has been made to keep the room free from dust. The gas-engine (which is of Tangye's make, and of 12-horse power), with its cooling vessels and meters, is placed on the floor of the engine-house; and a belt from a pulley transmits the power to the coal-breaker along an underground passage, covered by cast-iron floor-plates. There is sufficient room in the passage for a man to pass alongside the running belt; and dust is prevented entering the passage by means of a set of plates bolted to the wall-box through which the shaft passes. The power for driving the elevator and conveyor is taken from the end of the crank-shaft by means of a large friction clutch, with spur and bevel gear driving a vertical shaft going through the roof of the engine-house, and upward to the elevator and conveyor.

The coal-breaker is of very massive construction, having large cast steel claws, which, as Mr. Smith's visitors saw last Wednesday, are capable of crunching up pieces of hard cannel as large as 2 feet cubes. A second series of smaller claws breaks the material to the desired size. The elevator passes down into the coal-breaker pit directly in front of the breaker, and picks the coal up as it falls from the latter. It is constructed of strong proportions, and is capable of elevating 25 tons of coal per hour while running at a slow speed. The conveyor is of the scraper type; but the scrapers are not allowed to rest on the pan, but are carried on side wheels. The arrangement is quite free from noise.

Looked at critically, there can be no two opinions about this being a good example of sound and substantial construction; and one and all who were present at the inspection were thoroughly pleased with the splendid uniform heats, level charges, and rapid exit of the coke. Mr. Smith is evidently a great believer in the truth of the words that "trifles make perfection, and perfection is no trifle." Throughout the progress of the work, he made suggestions here and there, and insisted on this and that; and he has his reward in the possession of a plant which, from the first day it started, has proved its efficiency, and the contractors have theirs in the knowledge that they have given entire satisfaction to the Chairman of the District Council (Mr. John Stones), the members of the Council, and the Engineer. Mr. Smith reminded his visitors that the installation had only been at work about a fortnight, and that he was confident of improving upon the present good results as time went on. Although the men have had such short experience, a test shows that they are able to charge the whole of the retorts in sixteen minutes. At present 6½ cwt. charges are being worked, with six-hour runs; but shortly Mr. Smith proposes to increase the charges to 7 or 7½ cwt. As proof of efficient workmanship, he pointed out that in heating up only two or three almost imperceptible cracks had occurred in the settings; and his visitors were interested in a test which he applied to one of the settings in order to ascertain its temperature, which was found to be just about the melting-point of steel, or close upon 3000°. Already by his new plant Mr. Smith is realizing a saving of rather more than 1s. per ton of coal carbonized; and when other projects are accomplished matters, the resulting saving will be enlarged.

Talking of new projects, Mr. Smith hopes to be in possession, before the end of the year, of a railway siding, running from the London and North-Western line. It will have to cross a bridge over the canal bordering the works on one side, which bridge will have a span of 158 feet, and an elevation of 18 ft. 6 in. to the rails. There will be a single line across the bridge, and a double line on the works; the total length of the siding being 350 feet. This will undoubtedly prove an immense advantage in the direction of curtailing manufacturing expenses, and improving the conditions of labour. There is one thing that both the old and new retort-houses lack, and that is a system of coke conveying; but this deficiency will soon be a thing of the past, for a contract is already well in hand for the laying down of the necessary plant by the New Conveyor Company, Limited, of Smethwick.

From what has been written above, it will be gathered that now, and especially a little later on, there is, and will be, much worth seeing at the Smethwick Gas-Works; but these new things do not by any means exhaust all that is of interest to the Gas Engineer on the works. Mr. Smith has strong views on certain points of gas manufacture; and a visit to his works shows that these views are not founded on mere theoretical assumption, but on experience gained in practical working over a long course of years. Before concluding, mention may be made of a matter of historical interest. The premises adjoining the works were formerly those occupied by Boulton and Watt; and it was there that Murdoch erected his first gas plant. From the top of Mr. Smith's purifiers, one can see the dilapidated roof of the old retort-house; and on the site of Murdoch's gasholder now stands a holder for Dowson gas. From this primitive plant

Murdoch supplied his private house, which is still visible nestling among trees on a hill a short distance away. Mr. Smith possesses a relic associated with this first gas supply. It is a small piece of the "gas-main" which was used; and, in these days of india-rubber tubing and compo. piping for conveying gas, its appearance cannot fail to produce a smile. Its outside diameter is 3¾ inches one way, and another 3½ inches, while its internal diameter is only about 1¾ inches; so that the small stream of gas passing through it was encased in something like an inch of iron.

For the interesting information gained by the visitors during the inspection last Wednesday, thanks are due to Mr. Smith, his pupils and assistants (Messrs. S. T. Smith and Ernest Astbury), and Mr. Jenkins. On the invitation of the last-named gentleman, the members of the District Council, with a few friends, dined together in the evening at the "Blue Gates" Hotel; and the after-speeches testified to the gratification which the councillors had derived from witnessing the satisfactory operation of their new inclined retorts.

THE ESTIMATION OF FERROCYANIDES IN SPENT OXIDE.

A paper on this subject by Herren E. Donath and B. M. Margosches, has recently appeared in the "Zeitschrift für angewandte Chemie." The following is a summary of its contents.

Several methods have been propounded for the estimation of Prussian blue in spent oxide, of which it is often nearly the most valuable constituent. The authors have, however, endeavoured to find a more expeditious method of estimation than those now in use, and believe that the one about to be described is both exact and rapid. The ferrocyanides and ferricyanides of the alkalies, when in acid solution, resist the action of the majority of even powerful oxidizing agents; but when in alkaline solution they are easily decomposed by these agents. In this decomposition all the iron separates as a precipitate consisting chiefly of ferric oxide, in which the iron may be readily determined quantitatively.

For example, if a solution of yellow prussiate is mixed at ordinary temperatures with brominated solution of caustic soda (made by dissolving 80 grams of sodium hydrate in water, making up to a litre, and adding, with vigorous shaking, 20 c.c. of bromine), no change takes place; but on heating nearly to boiling, a dense precipitate of a beautiful brickdust colour forms, while gas is freely evolved. The reaction comprises two stages, in the first of which the ferrocyanide is converted to ferricyanide of the alkali; and in the second the oxidation proceeds farther, and complete decomposition ensues. [The authors propose to deal with the composition of the precipitate in a subsequent communication.] After it has settled by standing for some hours, if it is filtered and washed, the iron present in it may be determined by one of the customary methods; and the quantity of ferrocyanide deduced therefrom. The factor by which the amount of iron is multiplied is 7·5476 for crystallized potassium ferrocyanide ($K_4FeCy_6 + 3H_2O$), or 6·5833 for the anhydrous salt. The determination of the iron may be made either by dissolving the precipitate on the filter in warm dilute hydrochloric acid and precipitating the ferric hydrate with ammonia, or by drying the filter with its contents, transferring the precipitate to a small flask, dissolving it in dilute sulphuric acid, reducing with zinc, and titrating with standard solution of potassium permanganate.

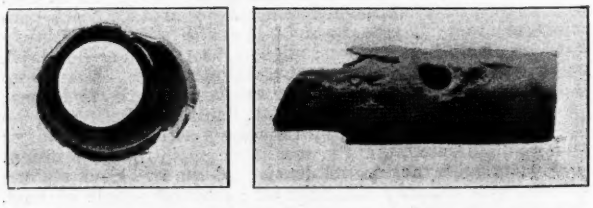
The authors obtained concordant results in using the method on yellow prussiate containing 99·6 per cent. of crystallized potassium ferrocyanide. The results were actually from 0·2 to 0·4 per cent. too low. Instead of brominated solution of soda, an alkaline solution of potassium permanganate may be used as the oxidizing agent. If a solution of potassium ferrocyanide is heated with an alkaline solution of potassium permanganate, the latter is reduced very rapidly; and a hydrated peroxide of manganese separates out along with the brick-red precipitate, which contains the ferric oxide. If permanganate is added until a permanent red colour is obtained, dilute hydrochloric acid, on heating, decomposes both the precipitate and the excess of permanganate, with liberation of chlorine. After heating to drive off the chlorine, and diluting, the iron may be separated from the greater part of the manganese by the acetate method. The iron in the basic iron acetate, which contains some manganese, is determined volumetrically with solution of potassium permanganate. The use of a brominated solution of soda is, however, the simpler means of carrying out this method of estimation, and is to be recommended—notwithstanding the relatively high cost of bromine.

Spent oxide contains a large quantity of sulphur and much tarry matter of a not readily volatile description. For the determination of the ferrocyanide present, the finely powdered oxide is digested at a gentle heat with a 15 per cent. solution of caustic potash, in order to convert the Prussian blue into ferric hydrate and potassium ferrocyanide. The liquid is then diluted, the residue filtered off, and dilute solution of potash is dropped on to the filter until the potassium ferrocyanide reaction no longer takes place. This rather tedious method of decomposing the spent oxide with caustic potash has lately been discarded by the authors in favour of the method by which Herren Moldendauer and Leybold prepare the material for their method of estimation. This method is as follows: The spent oxide is rapidly powdered and mixed in an iron mortar, and 50 grammes are weighed off from it. This quantity is put into a litre flask, and 100 to 150 c.c. of a 15 per cent. solution of caustic potash are added. The flask is then placed on a hot sandbath and frequently agitated for some time, then filled up with distilled water, and 30 c.c. added to allow for the volume occupied by the undissolved residue of spent oxide. After thorough agitation and filtering, the potassium ferrocyanide is determined in an aliquot portion of the filtrate according to the process described above. The volumetric estimation of the iron as protoxide by potassium permanganate is to be preferred. Even more satisfactory results may be obtained by working on the dried residue of spent oxide remaining after the extraction of sulphur and tarry matters by means of carbon bisulphide. The tarry matters and sulphur appear to prevent the conversion of small quantities of the Prussian blue into potassium ferrocyanide and ferric hydrate by the caustic potash.

Tests of a particularly rich spent oxide by this method showed 14·3, 14·54, 14·51, and 14·65 per cent. of crystallized potassium ferrocyanide; while another method gave 14·48 per cent. The authors' method determines ferrocyanide in the oxide whether present as Prussian blue or any other ferrocyanide compound.

AN EXAMPLE OF ELECTROLYSIS OF WATER-MAINS.

New York was the scene of two singular accidents about the middle of last December. On the 13th of that month, as our readers are aware, the inhabitants of the district in which First Avenue is situated were alarmed by the bursting of the tank of the new holder of the Consolidated Gas Company, with the result of flooding the streets and killing several people; while only two days previously a 4-feet water-main, located in the eastern part of Brooklyn also burst, doing a great deal of damage to adjacent property, and cutting off the water supply over a large area of the city. The cause of the fracture was stated to be a defective casting; but subsequent examination of the pipe revealed unmistakable evidence of electrolytic action. The break occurred in the vicinity of an electric power station; and it is believed that evidences of ground currents from the electric railways are to be found on the water-mains in many parts of Brooklyn, and were recently shown to have crossed the bridge and appeared on Manhattan Island. It appears to be a question whether the fire underwriters may not, in self-defence, be forced to increase the insurance rates in cities where water-mains have been injured by electrolysis. This matter was dealt with in a recent number of "Engineering News," from which the subjoined particulars, together with the illustration of a section of an 8-inch water-main recently taken up, are reproduced. The illustration is of interest, as an example of the effect of about four years' electrolytic action in thinning iron pipe, and also as a piece of circumstantial evidence upon the causes of the break in the large main above referred to. The hole in the upper side was originally plugged by a brass cock. The pipe was at first of fairly uniform thickness (about ½ inch) throughout its circumference, as shown by an inspection of the pipe at a point a few feet from the corroded section.



This specimen of corroded pipe was recently presented to the Executive Committee of the National Board of Fire Underwriters, together with a report upon it by their Engineer. He began by remarking that the Brooklyn accident had caused the attention of the community of Greater New York to be directed to the destruction going on underground to the water-pipe systems; and he went on to say that an examination made by him of a portion of the removed pipe once more gave evidence of what had been expected to happen if the authorities did not take the necessary and proper steps. In other words, the imperfect construction of trolley roads was causing slowly, but surely, the destruction of water and gas services throughout the country. With regard to the probable condition of the water-pipes in Brooklyn and the portion of New York City immediately above and to the north of the Harlem River, the Engineer stated that careful inquiry made among the employees of the Brooklyn Water Board brought to light the fact that the men were fully aware of the conditions existing, as they had been knocked down by the current while working upon the mains—being in some cases severely, and in others badly, injured. No effort had been made on the part of the insurance authorities to prevent this state of things; and yet it could have been prevented. He expressed the opinion that it must be stopped, or the community at large would inevitably meet with nothing less than a conflagration when the conditions for such an event happened.

It appears from the Engineer's report that one of the head employees at the Brooklyn Water-Works told the writer that one of the railway companies was actually using a 6-inch water-main as a return feeder; and the authorities were not objecting to it. Supposing this to be the fact, what would be the natural result in a short time? It has been proved that 1·5 volts difference in potential between a water-pipe and a rail is dangerous; and here was a case of the deliberate transmission of an enormous current at a voltage of anything between 250 to 400 between the wire and the underground pipes. If they were simply transmitting a current with a difference of potential of 15 or 20 volts., the facts were sufficient to prove that this voltage carried with it a current which would, of necessity, under natural laws, cause enormous destruction. As some proof of these statements, the Engineer called the attention of the Committee to a report published by the Trustees of the Dayton (Ohio) Water-Works, and quoted therefrom remarks to the effect that with 4·5 volts a 6-inch pipe becomes useless in five years, and that certain pipes have been destroyed even when located beyond the limit of danger. The question naturally arose as to what was the condition of the 6-inch pipes in Brooklyn, one of which had been used as a return feeder. This gave rise to two others: Can the destruction of these pipes be prevented? and, if so, how? The writer of the report thinks it can, by several methods. He says: "The most absolute way of preventing the destruction of underground pipes in a large community (like that of New York and Brooklyn) is to compel the overhead trolley to go underground, and use double metallic circuits, as has been done on the Metropolitan Railway lines on Manhattan Island. Admitting, for argument's sake, however, that the railway cannot, without undue expense, make this change, they should at least be compelled to immediately rebond their roads, and run return feeders having a conductivity and capacity equivalent to the greatest amount of current that may be required at any one particular time during the operation of the road."

Mr. John W. Hill, the Consulting Engineer to the Delaware (Ohio) Water Company, has just issued a report with regard to electrolysis of water-pipes. He says: "With reference to the electrolysis of the cast-iron mains in streets where the electric railway is placed, I was enabled to make a number of tests for electric current in the water-mains, at different points where the transfer of current from the rails of the track to the water-main, and from the latter back to the rails, was most likely to occur. From the data so obtained, I am inclined to think that no serious damage to the water-pipes has thus far occurred. The destruction by electrolysis of several galvanized iron service-pipes near the power station of the electric railway can be accounted for by their acting as electrodes to transmit the current from the water-main to the rails of the street railway. These services are, in all cases but one, connected to the main beyond the rails. Within the year the rail joints of the electric railway have been re-bonded, and the rails cross-bonded with copper conductors; since which time, no service-pipes, so far as known, have been injured by stray electric currents." Nevertheless he advises that steps should be taken at an early date to properly connect, with copper conductors of suitable size, the water-mains with the negative or receiving poles of the electric generators.

A NEW WATER-FILTER.

A new water-filter which is attracting the attention of German water engineers has just been brought out by Dr. Kröhnhe. The chief merit claimed for it is that it obviates the drawbacks attending the existing methods of cleansing, and frees the filter surfaces of all dirt deposits with thorough efficiency, without interfering with the filtering arrangements. The patent sand filter consists principally of a horizontal drum closed at both ends and revolvably placed between two hollow axles; the interior being divided by vertical transverse walls forming disc-shaped chambers, filled alternately with sand and water. The water chambers are so connected each with one of the hollow axles of the drum-casing, that a certain number of them receive the raw water from one of the axles, while the others give off the filtered water through the other axle. Between the raw and the filtered water chambers are the filter discs of sand, enclosed between fine metal sieves.

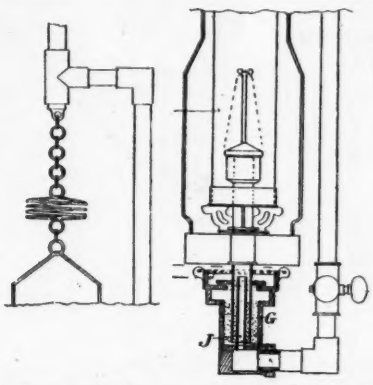
The sand chambers are for the most part, but not completely, filled with sand; the partition to the raw water chamber being entirely open, and that on the side of the filtered water chamber being only open to the extent of one-third of its surface at the bottom part. The sand discs present to the stream of raw water two filter surfaces—one in the segment covered by the sand, and the other in the upper horizontal surface of the sand deposit; both together being greater than the circular area of the surface of a single disc. The filter is made in duplicate and quadruple. It is claimed that the former has more than double, and the latter more than four times the effectiveness of one of the well-known horizontal filters of equal diameter, because the filter surface is greater than the circular area, and there is one disposable in each of the sand chambers. The filter may be constructed with any number of sand chambers; and in this way its capacity would be so much the greater than that of a like number of horizontal filters of the same diameter, without taking up materially any more room than one or two horizontal filters next to each other.

When the efficiency of the filter begins to be diminished by the accumulation of deposits on the filter surfaces, the cleansing can be effected by setting in a slow rotatory motion the drum by means of cog-wheel gear and a winch. First of all, however, by means of a valve arrangement, the current of the water is reversed, so that there is an outflow from the filtered water sides against the deposits on the outer filter surfaces. Meanwhile, the filter is kept continually revolving; and in this manner the sand is washed from all sides, grain by grain—the dirt deposit being triturated and driven off. No chance is given for the formation of channels, or of irregularities, as the sand in the sand chamber is kept shifting the whole of the time. A few minutes' turning mostly suffices to restore the filter to its former efficacy; and it can also be sterilized with but little trouble. Further, it is claimed that the ease with which the filter can be cleansed renders it possible to employ material of a fineness which is impossible, even with large filters, with the existing cleansing methods.

REGISTER OF PATENTS.

Incandescent Burner Fittings.—Sugden, D., of Bradford. No. 11,561; May 23, 1898.

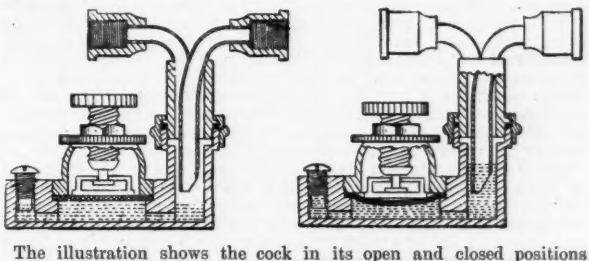
This invention refers to "the making of a connection, between the gas-main and an incandescent lamp, dispensing with the dangerous method of connecting with rubber tubing, as used at present with the anti-vibration system."



G is a metal box for holding mercury, screwed on to the gas-main; while at the bottom is fixed a vertical pipe J to conduct the gas from the main to the lamp. On the bottom of the lamp is fixed a down-pipe, which fits loosely over and around the vertical pipe; and to prevent this down-pipe from jarring against the vertical pipe J, a scroll spring, having a lateral motion, is fitted round the down-pipe. The box G is partly filled with mercury to prevent the gas from escaping; and on the top of the box is a larger box or chamber I for receiving the mercury which may overflow from below by the pressure of the gas.

Gas-Tap.—Gent, T. G., of Falmouth. No. 12,253; May 31, 1898.

This tap or cock is formed with a liquid cut-off—that is to say, the gas passing through it is freed and trapped by the displacement of a liquid, such as mercury.



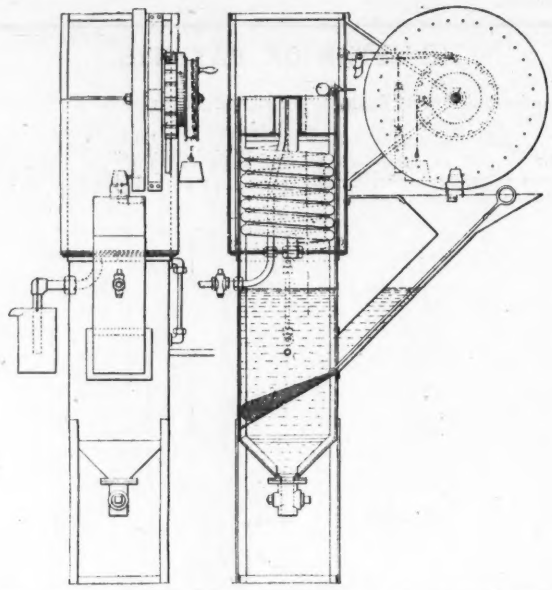
The illustration shows the cock in its open and closed positions respectively. The body of the tap is divided up into three compartments, in communication by holes through the walls separating them. The middle compartment is preferably the larger one, and contains the larger body of the mercury; but it is only a shallow receptacle open at top, but closed air-tight by a cap, which seals the mercury from the atmosphere. Through this cap a plunger works for the displacement of the mercury, operated either automatically or by hand. In the drawing it is shown as a quick-threaded screw-pin, having upon its inner end a fitted head carrying a leather disc or diaphragm which, when the screw is screwed down, acts upon the surface of the mercury, and displaces it into the right-hand compartment. The diaphragm also forms a means for making good the joint between the cap and the container.

The right-hand compartment is a gas-trapping chamber, into which the ends of the gas supplies depend, and within which the mercury is made to rise and fall, so as to establish and cut off communication between the supply-pipes by the action of the plunger—the mercury rising within the compartment sufficiently to cover up the end of one or both pipes, although the covering up of one end alone is accomplished in the form of tap shown. The end of the gas-pipe is chamfered off or cut on an incline, in order to obtain a gradual stoppage of the gas as the mercury rises to cover it.

The left-hand compartment is disposed around the shallow chamber containing the mercury in bulk, and is practically a pocket within which the mercury rises from the centre compartment. This pocket is fitted with a plug which can rise and fall; its purpose being to displace the mercury within the pocket and constitute a regulator to the height to which the mercury shall be displaced within the trapping-chamber by the action of the screw plunger. This regulator is of considerable importance, "inasmuch as it obviates the necessity of any exact calculation as to the amount of mercury required, and also allows for any inaccuracies owing to the tap or cock being at a slight inclination," although it is not absolutely necessary that such a regulator should be used.

Generating Acetylene.—Jackson, F. A., of Tonbridge. No. 13,029; June 10, 1898.

This apparatus belongs to the class in which a definite quantity of carbide of calcium is dropped automatically into a large excess of water every time the gasholder is exhausted to a certain point. The holder must therefore have an available capacity for storing gas somewhat in excess of the largest possible quantity the carbide can generate.



The apparatus (shown in the engraving) comprises a gas-generating water-tank, supported on legs, and having a bottom in the shape of an inverted pyramid or cone, with a large cock at the apex for emptying the sludge. At the side of the tank, about half-way down, is an inclined metal shoot of considerable section, terminating at the top in a hopper. Inside the tank, just below the junction with the shoot, is an inclined basket (of woven wire or perforated metal) attached to a long rod, by means of which it can be withdrawn and replaced through the shoot when required. Immediately over the gas-generating tank is a holder connected with the tank by a pipe passing through the dividing plate which forms the top of the tank and the bottom of the holder-sealing tank. This pipe mounts to the surface of the sealing-tank in a series of coils; so that the gas is thoroughly cooled as it passes up, and any condensed water runs back into the lower tank.

Above the hopper on the inclined metal shoot, a revolving disc is mounted. It is provided with spring clips or other appliances by which a number of small tins or containers, fitted with hinged lids fastened by spring catches, can be easily and rapidly mounted, removed, charged, and replaced round the disc, with their lids near the periphery and away from the centre of the disc. The tins are intended to contain equal and definite quantities of carbide. The disc may be revolved by a weight which can be wound up from time to time, or in any other suitable way. The motion of the disc is controlled by a ratchet-and-pawl escapement motion; the ratchet having preferably the same number of teeth as there are tins mounted on the disc. The motion is so connected with the bell of the holder that every time it descends to a certain point the ratchet-wheel is allowed to move round the space of one tooth; and one of the tins—that which is at the lowest part of the disc—has its spring catch knocked aside by a fixed projection on the hopper, and the charge of carbide at once falls into the hopper and down the shoot into the basket in the tank.

The level of the water in the tank is kept above the junction of the shoot, so that the water rises in the shoot sealing the opening. A layer of oil is preferably poured on the surface of the water in the shoot; and the carbide thus becomes coated with a film of oil which retards the reaction of the carbide with the water until the carbide has passed into the body of the tank. Action then commences; and the gas, which will not pass back up the inclined shoot on account of its construction, rises vertically and flows up the spiral pipe into the holder. The resultant lime drops through the perforations of the basket, to be removed through the sludge-cock; while other insoluble matter is arrested by the basket, to be withdrawn through the shoot.

Pellets for Igniting Gas.—Crowther, H. W., of West Bromwich, and Harris, H. G., of Upper Tooting. No. 12,505; June 3, 1898.

This is a modification of Jurgens' patent—No. 29,828, of 1837—which describes the manufacture of gas-burner ignition pellets of platinized kieselguhr or infusorial earth; the object being "to reduce considerably the quantity of platinum that is necessary, and to ensure certainty of action in all temperatures and all states of the atmosphere."

They propose to mix with the kieselguhr or material of which the body of the pellet is composed, matter that can be burnt or dissolved out and will be much reduced in bulk on heating—such as pure paper pulp, raw cotton, hemp, or silk. They would also use asbestos to cause the various portions of the pellet to cohere, and also to act as a mechanical binding material. A very suitable mixture is said to be 50 to 70 parts of kieselguhr, 20 to 30 parts of purified asbestos, and 10 to 20 parts of paper pulp or similar matter, all in a dry state. These are well mixed together and made into a soft mass with distilled water. The mass is then moulded into pellets which are dried in a water bath, and then saturated with a solution of platinum chloride ($PtCl_4$), again dried, and then ignited for some time in an atmosphere of hydrogen.

For causing the ignition of the gas, each pellet is made to carry a spiral of very fine platinum wire preferably threaded through a hole in the pellet before soaking with the solution of chloride of platinum, and treated with the pellet in the subsequent operations, as the patentees "have found it advantageous that the wire should have 'reduced' platinum on it; otherwise it is only with difficulty that the wire incandesces even after the pellet itself has become heated."

Burners for Acetylene.—Boult, A. J.; a communication from H. E. Shaffer, of Rochester, U.S.A. No. 1634; Jan. 24, 1899.

This invention relates to a burner for gases rich in carbon, whereby "the flame will be free from the fluctuations due to variations in pressure."

The illustration shows the burner as consisting of a body portion having gas-passages and an upwardly extending external projection A projecting between, and close to, the undersides of the flame from two burner-tips arranged with their discharge orifices at an angle. The projection provides a mass of material below the point of co-operation of the gas-jets. It "will be heated by the flames, and will re-act upon the gas, promote its combustion, and heat the air rising from below." The supports of the projection are reduced in size by cutting away so as to leave only a narrow neck offering a very small surface, and thereby preventing the conduction of heat back to the burner. The burner-tips (of soapstone, lava, or other refractory material) are provided with an entrance passage communicating with the inlet-chamber, and a discharge passage extending at an angle to the entrance passage, and having a minute gas aperture. This passage constitutes a chamber for thoroughly mixing the gas with air; and to accomplish this in the best manner, lateral air-inlets are provided about half below and half above the bottom of the discharge passage—the aperture being, of course, at the lower side of the lateral air passages. This insures the air entering the passages striking the column of gas at right angles, and when it first issues from the gas aperture provided. Near the outer end of the passage are very small lateral passages serving to admit air to the mixed column of air and gas near the point of combustion, and effectually surrounding it so as to prevent contact with the extreme end of the tip, and thus prevent any deposit of carbon thereon.

By arranging the passages at an angle, as shown, the tips may be combined to produce a flat flame and also a multiple burner with small round flames.

Gas-Engines.—Hirt, L. J., of Brookline, Mass., U.S.A. No. 5510; March 14, 1899.

This engine is said to be capable of operating as a constant pressure engine, and of being automatically converted into a variable pressure engine by diminution of the pressure of the gas employed to run it. The engine may be started under a constant pressure, and run as a constant pressure engine; gas being admitted and exploded at each stroke of the piston until the engine is running in the desired manner. The supply of gas and air, at a reduced pressure, may then be admitted to the engine cylinder; and the engine responds to the diminution in the pressure of the gas, and automatically converts itself into a variable pressure engine, in which the gas is exploded once for every two complete movements of the piston.

APPLICATIONS FOR LETTERS PATENT.

8538.—Davies, W. I., "Acetylene lamps." April 24.

8545.—Boult, A. J., "Carburation of gas." A communication from G. Peeters. April 24.

8572.—Fell, J. C., "Gasoline gas apparatus or carburetters." A communication from H. B. Cornish. April 24.

8595.—Bickerton, H. N., and Bradley, H. W., "Oil or gas engines." April 25.

8648.—Thompson, W. P., "Acetylene gas-generators." A communication from A. Wegmann-Hauser. April 25.

8662.—Reece, C. W., and Gaskin, T. H., "Apparatus for enabling the consumption of gas to be regulated." April 25.

8709.—Squire, W. S., "Controlling the flow of water in pipes." A communication from A. Wylie. April 26.

8739-40-1-2.—Wright, J. W. B., and Darwin, H., "Gas cooking-stoves." April 26.

8751.—Murphy, J., and Droege, W., "Preparation for imparting increased brilliancy to light, and durability to any fibre substance or other substance." April 26.

8752.—Shearer, M., and Wedderburn, J. W., "Gas-economizing device, for use in connection with the incandescent gas-light." April 26.

8764.—Fisher, H., "Gas-light distributor." April 26.

8765.—Boettcher, O., "Acetylene gas-generator." April 26.

8779.—West, J., "Regenerators for gas-retorts." April 26.

8831-2-3.—New, A. G., "Internal combustion engines." April 27.

8855.—Ayton, R. C., "Internal combustion engines." April 27.
8870.—Sugg, W. T., "Taps or cocks for use with high-pressure fluids." April 27.
8895.—Wild, M. B., "Mechanical conveyors and elevators." April 28.
8909.—Hulse, H., "Charging inclined retorts." April 28.
8930.—Wright, W. H., "Carburetters." April 28.
8958.—Sugg, W. T., "Incandescent gas-burners." April 28.
8985.—Shaw, J., "Taps and valves." April 29.
9035.—Pestel, E., "Acetylene gas apparatus." April 29.
9055.—Heinzel, R., "Chimney for incandescent gas-lamps." April 29.
9060.—Hansen, R. P., "Gas and petroleum motors." April 29.
9078.—Motley, T. H., "Gas or oil engines." May 1.
9091.—Codd, T. J., "Non-return valves." May 1.
9116.—Jenkins, W. J., "Conveying coke, coal, and other material." May 1.
9122.—Glover, R. T. & J. G., "Coin-freed machines." May 1.
9126.—Sugg, W. T., "Incandescent gas lighting." May 1.
9137.—Hatcher, F., "Gas-stove for cooking purposes." May 1.
9156.—Eldridge, H., Clark, D. J., and Blum, S. & A. A., "Manufacture of calcic carbide and illuminating gases." May 1.
9162.—Binns, J. P., "Gas and oil engines." May 2.
9187.—Legge, J. St. C., and Townsend, C. E. C., "Gas-burners." May 2.
9204.—Whitley, A. E., "Acetylene lamps." May 2.
9268.—Howles, F., "Manufacture of cyanides." May 2.
9273.—Daubenspeck, G., "Refractory incandescent mantles or hoods." May 2.
9322.—Ellen, W., and Davies, W. I., "Acetylene gas-generators." May 3.
9344.—Frenz, W., and Sieverts, W. H. A., "Automatically cutting off and opening the supply to gas lamps or burners." May 3.
9358.—Mitchell, E. A., "Generating, storing, and enriching or mixing gases." May 3.
9380.—Firth, G. H., Bentham, F. H., and Stott, J. H., "Incandescent gas-burners." May 4.
9390.—Hardy, J. T., "Combined governor and self-lighting gas-burner." May 4.
9393.—Willis, P. R. J., "Apparatus for drawing coke." A communication from J. A. Hebb. May 4.
9432.—Hemingway, H. W., "Desulphurization of sulphuretted hydrogen." May 4.
9438.—Wirtz, L., "Manufacture of ammonium sulphate." May 4.
9488.—De Mynn, W. P., and Higgins, W., "Making acetylene gas." May 5.
9493.—Glasgow, A. G., "Improvements in gasholders for equalizing intermittent gas production and other purposes." May 5.
9504.—Goodson, J., "Gas-governors." May 5.
9573.—Clarkson, T., and The Clarkson and Capel Steam Car Syndicate, Ltd., "Burning inflammable gas or vapour." May 6.
9593.—Pryor, H., "Elevators or conveyors." May 6.
9602.—Wiese, E., "Lighting gas-burners." May 6.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Hastings Water-Gas Plant.

Sir,—The fact that we were the manufacturers of the water-gas plant at Hastings renders the paper read by Mr. C. F. Botley at the last meeting of the Institution of Gas Engineers, on "The Practical Working of Carburetted Water Gas," and the discussion, of much interest to us.

We would say, in regard to the duty obtained from the oil during the period when the plant was in use prior to the adoption of Mr. Botley's modification, that it is now some years since the apparatus was started; that much has been done by ourselves and others in developing and perfecting the various details of this special apparatus since then; and that there is no doubt that much remains to be done, and is still being done, in the same direction. Results that would have been considered satisfactory in the early days of the introduction of water gas into this country would be regarded as very indifferent now.

Reference was made to the separator. This is a part of the plant to which we have given a good deal of attention; the apparatus provided in the early plants which had come under our notice seeming to suggest to us much improvement. More still remains to be done, as this dividing up of the effluents is a complex matter. Considerable variations appear under apparently uniform conditions. It happens that a few days ago we caused careful analyses to be made of the tar drawn from one of our separators on several successive days, when working under apparently the same conditions. One day's test was as low as 4 per cent. of water, several under 15 per cent., while on two occasions a much larger percentage was disclosed, although at all times the separated water returned for use in the scrubber was quite free of tar or scum. However good the separator, it seems desirable to provide another settling tank, from which the tar may be drawn for sale.

With respect to the interception of dust escaping from the smoke-stack. So far as we are aware, no attempt was made to obviate this objectionable accompaniment of water-gas manufacture until in the case of an important plant we erected in a provincial town. In that instance serious attention was called to the matter by the Gas Company's neighbours; and the Directors placed on us the obligation of dealing with it. The result was the devising of the apparatus, for which we secured a patent dated April 13, 1898, which was described in the "Register of Patents" in the "Journal" for March 21 last, p. 725. In arranging this simple but effective device, we believed we were quite original; but if otherwise—as would appear from the President's description of what he has put into use in connection with a cement works in Denmark—it is but another illustration of how minds intent on similar objects often trend in the same direction. At any rate, it has been applied to several of the plants put up by us, and always with entire success.

Regarding the cost of wear and tear. This is known to be a very uncertain element, depending much on local circumstances, and on the way these matters are regarded in any particular gas-works. But, in comparison with what was asserted at the meeting, we have before us a statement of the working of one of our important plants where, during a period in which the production was over 350 million cubic feet, the cost of all repairs of every kind and sort was a sum which works out at 0·09d. per 1000 cubic feet of gas made.

There is another special feature in our plant which we think deserves somewhat more special mention. That is our patented arrangement of interlocking gear, which effectually prevents the possibility of the simultaneous opening of the valves respectively controlling the admission of air and steam to the generator. There is always risk of this if these valves remain free and independent of each other, and the operator should in a moment of forgetfulness overlook the proper sequence, when obviously serious consequences would ensue. Our device absolutely avoids this risk, and has been adopted with success in all our plants.

In conclusion, we should like to express our obligations to Mr. Botley for the very active and intelligent interest he took in the plant at Hastings throughout its entire construction—often with much advantage to ourselves. The success of the appliance for atomizing the oil is proved to demonstration. The only question in our mind is, as Mr. Botley is aware, as to whether air is quite the proper medium for the purpose. We further think there is much cogency in his remarks as to the varied conditions under which tests are sometimes made, and results claimed, and the desirability of making these conditions as uniform as possible.

Millwall, E., May 11, 1899. Samuel Cutler and Son.

The Manufacture of Soot as a Bye-Product in Gas-Works.

Sir,—Mr. Jehl's writing on this subject in the "Electrician" I cannot really allow to pass. That soot could be a bye-product of electricity, any one who has seen the chimney of an electric light station smoking will admit; but when a gas manager sees smoke issuing from his works' chimney, he at once concludes that something is wrong—so very unusual is it for the chimney of a gas-works to smoke. If it does, either the exhauster has broken down or scurfing operations are going on. But, on the other hand, electric light stations are great sinners in this respect; and why the police do not "come about the owner's ears" is best known to the manager.

Of course, there are exceptions; and I have in my eye a fair city in the North, where they use only gas coke in their electric light station, and consequently the blue sky that frames the cope of their smoke (?) stack is as pure as that over its heather hills.

By all means let the electric light stations go in for soot or lampblack; but it will not pay in a gas-works, where, as a rule, the furnaces are of proper construction even when tar is used as fuel. Let anyone look at the chimney of a gas-works day by day, and convince himself of the fact that we consume our own smoke; and that is what electric light stations do not do. I recommend lampblack to them.

Montrose, May 10, 1899. T. D. Hall.

Heywood Corporation Gas Supply.—At the monthly meeting of the Heywood Town Council last Thursday, Alderman Marlor, the Chairman of the Gas Committee, informed the Council of the result of the gas undertaking during the past year. He said the gross revenue amounted to £19,163, and the gross expenditure, less interest and sinking fund, to £12,620; leaving a gross profit of £6543. The net profit was £1638, and was £201 more than last year, notwithstanding the reduction in the price of gas of 2d. per 1000 cubic feet from last September. The Committee had decided to transfer £1379 of the profit to the district fund in relief of the rates; and the balance of £259 would be placed to the reserve fund, which would stand at £3000.

Bristol Public Lighting.—According to the report of the Gas Examiner for Bristol for the three months ending March 31, there are now 7397 gas-lamps in the streets of Bristol, the vast majority of them being fitted with burners consuming 5 cubic feet per hour. There are only 171 lamps with larger burners. These 7397 lamps burnt 39,539,389 cubic feet of gas in the quarter, which, at 2s. 2d. per 1000, comes to £4283. Including the gas used at the public offices and hospitals belonging to the Corporation, lighting, cleaning, and renewals, and £60 for oil-lamps, the public lighting bill came to £6164 for the quarter—for gas and oil only. The rate is 2d. per 1000 feet less than that charged to householders; the Company being bound by statute to supply the Corporation at the minimum rate charged to any consumer.

The South Molton Gas-Works and Posterity.—A novel and interesting suggestion was made in the course of a discussion which took place at the meeting of the South Molton Town Council last Tuesday. The Corporation recently purchased the gas-works, and Alderman Shapland took occasion, on the presentation of the report of the Gas Committee, to express the hope that the day was not far distant when they would be able to reduce the price of gas. Mr. D. Richards, in reply, said they made a profit on the last year's work of £346, of which £310 would have to be devoted to the payment of interest and the reduction of the capital. They would pay off the debt on the gas-works in about seventeen years. It was unfair that they should lay the whole of the burden on the consumers. The Council were getting a return of 8 per cent from their outlay on the works when they ought to be contented with 5 per cent., and take the rest out of the rates. Mr. J. Vernon characterized this as a most astounding scheme. They told their constituents that the gas-works would be self supporting; and they had been during the last twelve months. But it was now suggested that they should relieve the consumers at the expense of the ratepayers. There was no hardship upon the consumers, who were getting gas cheaper than they did under the Company. Mr. R. Cock contended that it would be most dishonest to make ratepayers who were not consumers help to pay for the gas, especially where the ratepayers were poor people. The Mayor (Mr. J. Sanders) said the question was one of simple justice. The Council had that day made a rate which would not cover their liabilities, and they would have to draw upon the future because they thought it right that posterity should help to pay for improvements they made. The gas consumers were to-day contributing this sum of £300 of which posterity would reap the sole benefit. The matter then dropped; but it is apparently to be revived on another occasion.

PARLIAMENTARY INTELLIGENCE.

Gleanings from the Committee Rooms.

The House of Lords Committees seem bent on creating precedents this session in connection with gas legislation. First there was the lowering of the initial price in the Lea Bridge case, and now we have Lord Ribblesdale's Committee giving a decision on the Loughborough Corporation Bill, the gravity and importance of which cannot be overrated. For the first time in the whole history of gas legislation, a Parliamentary Committee have in effect declared that a Local Authority may, if they so desire, take possession of the undertaking of a gas company, without having any substantial charge to bring against them. An attempt was made during the proceedings to show that Morley was a case in point; but it was not a case of compulsory purchase at all. Before Parliament was approached, there had been negotiations between the parties; and, moreover, the Town Clerk had, at one stage, been asked by the Directors of the Company to prepare an agreement for transfer. Therefore, to call that a case of compulsory transfer against the will of the Company is really almost absurd. In the present case, Mr. Worsley Taylor, for the Corporation, confessed that they had "no serious complaints to make against the Company;" and he based his appeal for a favourable decision almost solely on public policy. Public Policy is a veteran in the Committee Rooms; and is always made to come up smiling when a local authority have a weak case, and nothing more substantial with which to back it up. Some effort was made when evidence was reached to show that the Company had failed in certain respects. But this change of front between the opening of Counsel and the examination of the witnesses did not escape the Committee. In fact, in announcing their decision to allow the Bill to proceed, the Chairman distinctly intimated that the evidence had not influenced them in the least; their decision having been entirely arrived at from the point of view of the aforenamed Public Policy. No witnesses were called on behalf of the Company against the Bill, as it was desired to reserve the evidence to support the Bill which they themselves were promoting. At the risk of being told that it is easy to be wise after the event, we cannot refrain from expressing the opinion that a little evidence in opposition would not have been amiss. But the decision has been given; and it is earnestly hoped that the Company, recognizing its full gravity, will oppose, with might and main, both in their own interest and in that of gas companies generally, the Corporation Bill when it comes before a Committee of the House of Commons. The engineering evidence for the Corporation was furnished by Mr. E. H. Stevenson, and Mr. Alfred Colson; and the witnesses who were prepared to be called on behalf of the Company were Mr. George Livesey, Mr. Corbet Woodall, and Mr. Charles Hawksley.

As originally introduced, the Omnibus Bill of the Belfast Corporation contained three clauses referring to their gas undertaking which were modest in appearance and fair in intention. The Bill has been in Committee during the past week; and the gas section was reached on Wednesday. It was announced that the first clause—which was to authorize the Corporation to devote to the purposes of the gas undertaking certain lands now used by them as an abattoir and storeyard—had been withdrawn. The next clause, however, dealt with a matter which has been a perpetual source of worry to the Gas Department for years past—that is, the question of discounts on gas charges—and consequently it was not so easily disposed of. In the days of the old Company, when perhaps there was some reason for granting a big discount to secure a big business, a scale of discounts was instituted and legalized which has for a long period acted as a drag on the undertaking. The discounts allowed are in proportion to the consumption; but changed conditions —the lower price now charged, and the larger consumption of gas— have produced this anomaly, that manufacturers in certain instances are able to obtain their gas at practically cost price. This is manifestly to the detriment of the consumers of smaller quantities of gas, who must, in consequence, pay a higher price than in justice they should be called upon to do, in order to supply the profit which the undertaking is expected to yield. The Corporation now sought to repeal the sections of the old Acts which regulated and defined these discounts, and to substitute therefor a clause making it lawful for them to allow a discount of 5 per cent. upon each quarterly payment made by a consumer within 21 days after the rendering of the account. A great deal of evidence was laid before the Committee on this question; but, unfortunately for the gas undertaking and the smaller consumers, they rejected the clause. Further reference to the matter will be found in our editorial columns to-day. By the succeeding clause, the Corporation desired to repeal section 138 of the Belfast Water Commissioners' Act of 1840, and to subject the laying, relaying, or removing of gas-pipes to the provisions of the Gas-Works Clauses Act, 1847, for the protection of water-pipes. Section 138 of the Water Commissioners Act of 1840 prescribes what has been found to be an unworkable distance for the position of gas-mains in relation to the water-mains. Before the Bill came before the Committee, a compromise was effected between the Commissioners and the Corporation; and a new clause, which will be mutual in its operation, was drawn up to take the place of the one originally appearing in the Bill. It provides that the Corporation are not to lay gas-mains, without the consent of the Commissioners, nearer than 2 feet to any water-main or nearer than 1 foot to any hydrant; and the Commissioners are bound in a similar manner in regard to the laying of their pipes. There are also other stipulations as to the crossing of mains, and the application of the Gas and Water Works Clauses Acts of 1847 to the execution of pipe work.

The Tramways and Improvement Bill of the Bradford Corporation had a successful run so far as the proceedings were carried last week before the Commons Committee presided over by Mr. Molloy. The Corporation were victorious over their competitors—the Leeds City Council—in regard to the tramway section of the measure. Then followed the gas clauses, by which the promoters were seeking power to purchase the intra-mural portions of the undertakings of the Shipley and Pudsey Gas Companies; and before the Committee rose on Friday, the Chairman intimated that they were satisfied with the promoters' evidence on this part of the Bill, but they were prepared to receive any evidence the Companies thought would tend to modify or alter the view he had expressed. Mr. Worsley Taylor, for the Pudsey Company, acknowledged the significance of the hint from the Committee, and asked to be allowed until Monday morning to determine the course he would take. The simple facts of the case are these: The Corporation Act of 1871 gave them the power to supply gas within the whole of the borough boundary. By another Act passed ten years later, the boundary was extended; but the rights of the Gas Companies supplying in the added area were protected by special clauses. This created an anomaly which has given rise to much discontentment. In the portion of the borough supplied by the Pudsey Company, the charge is 2s. 6d. per 1000 cubic feet, with discounts ranging from 2½ to 10 per cent. for prompt payment; while in the adjoining streets the Bradford Corporation supply their consumers at 2s. 3d. per 1000 cubic feet, allowing discounts varying between 2½ and 12 per cent. In the case of Shipley, the Company charge 3s. 4d. per 1000 cubic feet, less 7d. discount. The levelling down of the prices is the main reason for the Corporation's desire to purchase; and, in the second place, they have an objection to outside bodies having the power to break up their streets. Through Mr. Balfour Browne, the Corporation stated that they were proposing to purchase on arbitration terms, and that, if the petitioners would not put the Corporation to further trouble, they would admit this was a compulsory sale. Mr. Charles Wood, the Corporation Gas Engineer, gave evidence on Friday; and Mr. W. A. Valon and Mr. Charles Hunt were also in attendance on the same side.

Yesterday morning, Mr. Worsley Taylor announced his intention of proceeding with the Companies' case. But the other side had not called the whole of their expert witnesses; and he objected to his experts being sandwiched between theirs. The Chairman remarked that it seemed to him the question was entirely one of compensation; and this could be dealt with when the clauses were considered, upon which Mr. Freeman, for the Corporation, said he would withhold his witnesses until then. The Chairman further suggested that an agreement should be arrived at between the parties; stating that the view of the Committee was that the compensation should be such that neither of the Companies should suffer in any sense in their financial position. Mr. Freeman expressed his willingness to discuss the terms of a clause with his learned friends; but Mr. Worsley Taylor elected to proceed. Addressing the Committee, he stated that there was absolutely no precedent for severing a gas company's undertaking in the way proposed; and he challenged the other side to produce one. The project was, he said, flagrantly unjust; and to sanction a transfer of this kind, even on the best terms that the ingenuity of man could devise, would be unfair, and contrary to the practice of Parliament. The price charged by the Pudsey Company for gas had been gradually reduced until now there was only 3d. difference between Pudsey and the Corporation; and if they were allowed to remain in possession of their entire district, they would no doubt soon reach the Bradford price, but if the severance took place it would imperil further reductions, which would be manifestly unfair to the consumers in the remaining portion of the district. At the close of Counsel's address, Mr. Corbet Woodall, Mr. E. H. Stevenson, and Mr. Thomas Newbigging gave evidence on behalf of the Companies; and Mr. Claude Baggallay (representing the Shipley Company) then summed up. The Committee afterwards deliberated in private; and on the parties being re-admitted, the Chairman simply announced that the preamble of the Bill so far as the gas clauses were concerned was not proved. It is difficult to say which side, in view of Friday's pronouncement, was most astonished by this decision, which once more exemplifies the glorious uncertainty which reigns in the Committee Rooms of Parliament.

The Committee of the House of Commons to whom the Bills of the Derby, Leicester, and Sheffield Corporations, claiming the waters of the Upper Derwent for the augmentation of the supply of these towns, came to a rather important conclusion at the close of the proceedings last Friday, which was the fourteenth sitting. The Derby Corporation at first wished to have control of the entire watershed; but they were willing to admit Leicester to a share of it on terms. They, however, disputed the right of Sheffield to any portion. The preliminary attempts at a compromise were not entertained; and there appeared to be an opinion outside Sheffield that the claims of the Corporation were quite worthless. But the arguments adduced on their behalf were not to be ignored; and a compromise was effected—with Sheffield left out. This position has now been changed. The Chairman of the Committee (Sir John Brunner), speaking for himself and his colleagues, said their opinion was that Sheffield must not be excluded from the coveted gathering-ground. They had arrived at the conclusion that some proportion of the total quantity of water available should be allotted to Sheffield; but what the proportion was to be they could not then decide. This pronouncement is regarded as fully justifying the action taken by the Corporation, and moreover as settling satisfactorily, from their point of view, the most important question under discussion.

The Bill to constitute a Water Board for the urban districts of Newhaven and Seaford, and to transfer thereto the undertaking of the Newhaven and Seaford Water Company, came before a Committee of the House of Lords, presided over by Lord Loch, on Monday last week. It was opposed by the Company immediately concerned; and the Lewes Water Company likewise opposed it, on the ground that the Board proposed to obtain their water from the Company's area of supply. A petition against the Bill was presented by the Lewes Town Council for the same reason. After the case had been opened by Mr. Ram, in the absence of Mr. Balfour Browne, Mr. E. J. Gorringe, the Chairman of the Seaford District Council, was called, and expressed the opinion that the water undertaking could be efficiently managed by a Joint Board. He was followed by Mr. Baldwin Latham, whose estimate for the purchase of the site at Kingston, and the construction of the pumping-station, mains, and reservoirs, was £28,200, and Mr. E. K. Burstal, who also gave engineering evidence. This brought the first day's proceedings to a close; but before adjourning, the Chairman asked if there was any possibility of the parties coming to an amicable arrangement. This, however, was not done; and the inquiry proceeded on Tuesday, when the promoters' case closed. Evidence was then adduced for the opponents of the measure; and Counsel addressed their Lordships. In the end, the Committee threw out the Bill. This result was doubtless disappointing to the promoters, who made a serious mistake in proposing to sink a well within a mile of one belonging to another water undertaking; and the case for Lewes was unanswerable. In fact, the opposition of both Companies was very ably conducted; and the decision did not come altogether as a surprise to those who followed the proceedings.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills brought from the Commons, read the first time, and referred to the Examiners: Ayr Burgh Bill, Gaslight and Coke Company Bill, Goole Urban District Council Bill, Scunthorpe Urban District Gas and Water Bill.

Bills read a second time and committed: Brigg Urban District Gas Bill, Shotley Bridge and Consett District Gas Bill.

Bills reported: Bury Corporation Water Bill, Loughborough Corporation Bill, Metropolitan Water Companies [Government] Bill, Newhaven and Seaford Water Bill [preamble not proved], Nuneaton and Chilvers Coton Urban District Council Water Bill; Salford Corporation Bill, St. Neots Water Bill, South Essex Water Bill [preamble not proved], Wakefield Corporation Bill, Wishaw Water Bill.

Bills read the third time and passed: Dundee Gas, &c., Bill, Gainsborough Urban District Council (Gas) Bill, Great Yarmouth Water Bill, Hastings and St. Leonards Gas Bill, Horsforth Urban District Council Water Bill, Leigh-on-Sea Urban District Council Bill, South Hants Water Bill, Stockton and Middlesbrough Water Bill, Totland Water Bill, Wishaw Water Bill.

Bill withdrawn: Loughborough Gas Bill.

The opposition to the Stretford Gas Bill has been withdrawn.

HOUSE OF COMMONS.

Thursday, May 11.

GASLIGHT AND COKE COMPANY BILL.

On the motion for the third reading of this Bill,

Mr. PICKERSGILL asked the House to postpone the third reading upon considerations which, he said, the Committee were not competent to, and did not in fact, inquire into. The Bill enabled the Company to raise 2½ millions of additional capital; and it would, if passed, put the Company in a position to be independent of Parliament for ten or twelve years at least, and that at a time when a Select Committee of the House were inquiring into the management of the affairs of the Company. He submitted that Parliament ought not to give them these new and larger powers until that Committee had reported. His complaint against the Company was that they had broken the terms of a statutory bargain, and had not conducted their affairs with due care. He remarked upon the extraordinary difference in the price charged by the Company and that of the South Metropolitan Company; the latter being 2s. 2d. per 1000 cubic feet, as compared with 3s. charged by The Gaslight and Coke Company. And it was a curious fact that this charge of 3s. only applied to the area north of the Thames, the consumers on which were paying more because the Company were selling gas at less than cost price to those on the south side. Not only was there this difference in price between the two Companies, but it had been a gradually growing one in the last ten years; and, if nothing was done, he feared it would continue to grow. He moved the adjournment of the debate until the Select Committee on the Metropolitan Gas Companies' Charges had reported.

Mr. PIRIE, in seconding the proposition, said if the House wished the Committee to be a reality, and not a sham, it would fall in with the views of his honourable friend. The Committee were without doubt appointed to inquire into the conduct of this particular Company; and the evidence already taken proved that, of all the Metropolitan Gas Companies, this was the worst-managed, and charged the highest price.

Sir W. CODDINGTON, as Chairman of the Committee on the Bill, said that almost all the arguments the honourable member had adduced were put before the Committee by Counsel, and fully gone into. It was proved that it was absolutely necessary that the Company should have power to raise new capital; but the Committee reduced the amount asked for from 3½ millions to 2½ millions. Counsel who opposed the Bill did not produce a single witness against it. All the evidence was in favour of the Bill; and the Committee were satisfied that it was a fair and proper one to pass. By reducing the amount of the capital asked for, they would compel the Company to come to Parliament again within a reasonable time. He should therefore oppose the motion.

Mr. J. SAMUEL supported the adjournment, and remarked that the City Corporation and the County Council did not tender evidence against the Bill, because they had decided to produce it before the Committee appointed to consider the positions of the gas undertakings generally. The House would incur a grave responsibility in giving the Company the proposed huge monopoly. It was estimated that the new capital would last them fourteen years, which was too long a lease to give them, especially in view of the fact that they charged such high prices for gas, and paid the maximum dividends.

Mr. LOUGH pointed out that the Company charged 33 per cent. more for gas than their rivals, and that a reason alleged was that they managed their capital worse than other Companies. His honourable friends did not propose to throw out the Bill, but simply to wait until the Select Committee now sitting had given judgment. Certainly, if the Bill were passed now, the Committee might very well cease their labours.

Sir F. DIXON-HARTLAND, a member of the Committee now sitting, said it seemed to him that it would be a perfect farce to pass this Bill at the present juncture, as any recommendation they might make would be simply worthless.

Mr. BANBURY, also a member of the present Committee, approved of the passing of the Bill, because if its consideration were postponed, it would be impossible for it to go through both Houses this session. If the Bill were passed in this House now, any representations the Committee now sitting chose to make could be dealt with in another place.

Mr. MOON feared the House would stultify itself if it passed the Bill now.

Mr. KIMBER pointed out that the Bill would not increase the price of gas to consumers, but would give the Company power to reduce it. The Company merely asked for assistance to carry out duties imposed by Parliament.

Mr. S. BUXTON contended that they would be stultifying the action of the House in appointing a Committee to inquire into the charges of the Metropolitan Gas Companies generally if they agreed to the third reading of the Bill.

Mr. J. W. LOWTHER considered that the contingency that the Committee might make a report which might or might not have some influence on the Bill was too remote to be taken into consideration. Legislation based on the report would be applicable not only to The Gaslight and Coke Company but to the other London Gas Companies; so that no advantage would be gained by penalizing this Company and leaving the others free. Under these circumstances, he considered the debate ought not to be adjourned.

Mr. B. L. COHEN intimated that he would not vote on a matter which was *sub judice*.

After a few remarks from Mr. BARTLEY in favour of the adjournment, and by Mr. JOHN AIRD against it,

The House divided, and the numbers were: For the adjournment, 121; against, 166—majority against, 45.

Mr. LOUGH said he believed several members had taken part in the division without thoroughly understanding the question raised; and so impressed was he by the gravity of the position, that he should take a division against the third reading of the Bill.

The House again divided, when the numbers were: For the third reading, 185; against, 114—majority, 71.

The Bill was then read a third time and passed.

Friday, May 12.

EAST LONDON WATER BILL.

On the order for the consideration of the East London Water Bill,

Mr. STUART moved the following clause: "If the undertaking of the Company is purchased within seven years from the passing of this Act, otherwise than by agreement, by any public body or trustees, nothing in this Act shall authorize the Company to bring into account, or to make any claim in respect of, any advantage conferred on them by or resulting from the passing of this Act." The restriction of this clause had, he said, very high authority—not only that of three different Committees of this House on three separate occasions—in 1886, 1896, and 1898—but also the authority of a Royal Commission; and the only result of the acceptance of the clause would be to bring the Bill into harmony with the determination of different Committees of the House. In the present Bill, there was the more reason for inserting the clause than there was in the Government Bill, because not only did it facilitate inter-communication, but it gave power to draw additional water from the Thames, and make certain reservoirs with the object of providing for the increasing population of the East-end of London. He recognized that the growth of population must be provided for; but he claimed that any increased value given to the undertaking by such provision should not be allowed to be brought into account in the question of purchase. The position of the London Water Question was very serious; and the introduction of this clause was the only way by which justice could be done, pending the report of the Royal Commission.

Sir J. PEASE, as Chairman of the Select Committee on the Bill, protested against the way in which the London County Council tried to induce the House to upset decisions of their own Committees when these had had all the facts under consideration. The Committee had the precedent of the clause in question before them; and they came to the conclusion that the clause was unnecessary. No reservoir to be constructed under the Bill could be in working order for seven years from its passing; and supposing it was not ready at the end of that time, how could an unused reservoir possibly add to the value of the Company's undertaking? Supposing it was finished, then the sinking-fund clause would come into operation as soon as water was taken out of the reservoir for public use. No profit whatever could arise—first of all because the reservoir would not be finished within the time in which the proposed clause would work, and, in the next place, by the operation of the sinking fund. He contended that it was a dangerous practice for the House to upset, on *ex parte* statements, decisions of Committees which had been quietly and solemnly arrived at.

Mr. CHAPLIN said he agreed entirely with what had been said by the honourable baronet. He thought the House would do well to bear in mind what had happened on former occasions when Bills of this nature had been rejected.

Mr. PICKERSGILL remarked that the right honourable gentleman's warning was unnecessary, as there was no desire to throw out the Bill, or to oppose its progress in any possible way. The question was whether or not the amendment should be adopted.

Mr. ARNOLD-FORSTER, a member of the Committee by whom the Bill was considered, remarked that this matter occupied their attention three or four days. He therefore thought it ought not to be fought out again in the House.

Mr. NUSSEY pointed out that he also was one of the members of the Committee, and that he felt it his duty to divide them on this subject, because he was driven to the conclusion that it was not necessary for a temporary Bill to be passed.

The House divided, and the numbers were: For the clause, 73; against, 185—majority, 112.

The Bill was then ordered for third reading.

The following further progress has been made with Bills:—

Bills read the first time and referred to the Examiners: Glasgow Corporation Gas and Water Bill [Lords], Hastings and St. Leonards Gas Bill [Lords], Local Government Provisional Orders (Gas) Bill [Ashburton, Wallingford, and Wokingham Orders], South Hants Water Bill [Lords], Stockton and Middlesbrough Water Bill [Lords], Totland Water Bill [Lords].

Bill read a second time and committed: St. Albans Gas Bill [Lords].

Bills reported: Belfast Corporation Bill, Cambridge University and Town Gas Bill [Lords], Coalville Urban District Gas Bill [Lords], Glastonbury Water Bill [Lords], Manchester Corporation (General Powers) Bill, West Gloucestershire Water Bill.

Bills read a third time and passed: Ayr Burgh Bill, Gaslight and Coke Company Bill, Goole Urban District Council Bill, Perth Water, Police, and Gas Bill [Lords], Redditch Gas Bill, Shirebrook and District Gas Bill, West Middlesex Water Bill.

HOUSE OF COMMONS SELECT COMMITTEE.

Thursday, May 11.

(*Sir* JAMES RANKIN, *Chairman.*)

THE POWERS OF CHARGE OF THE METROPOLITAN GAS COMPANIES.

On the Select Committee resuming to-day their inquiry into the above subject, it was announced that sittings would be held twice a week in future. The first witness called was

Mr. H. E. JONES, M.Inst.C.E.

Witness said that he had since 1880 been Chief Engineer and General Manager of the Commercial Gas Company. From 1875 to 1880, he was joint Engineer with the late Mr. Robert Jones; and from 1869 to 1875, he was Engineer to the Ratcliff Gas Company, who were amalgamated in 1875 with the Commercial Company. He was thoroughly conversant with the management of Gas Companies, and the economical production of gas. He described the district of the Commercial Company, which commenced at the outskirts of the City—Whitechapel—at the Butcher's Shambles, and terminated at the River Lea on the eastern side, except for a small part of West Ham. The southern boundary was the Thames, and the northern boundary the district of The Gaslight and Coke Company, on an irregular line from Victoria Park to Shoreditch. The district comprised the whole area occupied by the older docks on the north of the Thames, and was inhabited chiefly by the working classes employed at the river side, the docks, or in the City of London. Besides the docks, the district was occupied by warehouses, manufactories, and goods yards along the north bank of the Thames, whose operatives lived near by.

The CHAIRMAN: Do you wish to found any statement on the position of your district as to either advantage or disadvantage?

Witness: It is beyond question the worst part of the Metropolitan, or even the Metropolitan suburban area, by reason of having largely lost the trade which attached to the older docks, which trade has left the district through the construction of larger and more convenient docks lower down the river. All the older docks on the north of the Thames were originally in the Company's district; but the new ones at Barking and Tilbury have taken a large and important part of the shipping trade away. The Custom House offices close at 4 o'clock; and there is practically no work at the docks after that hour. There is therefore very little gas consumed there; and there is no night work at the docks requiring gas. In this way, the district has been heavily depleted of gas consumption.

Does that mean that your consumption of gas has not increased?—Not only has it not increased, but it never was very considerable for the area over which the mains had to run. While the population of the Commercial district is 470,000, or roughly one-eighth of the population (3,709,000) of the districts of the South Metropolitan and Gaslight and Coke Companies, the rateable value (£2,120,000) is only one-sixteenth of the combined rateable value of the other two Companies, which is £33,200,000. The district is exceptional in having no attractive suburban area, no room for extensions by building, and practically no middle or upper class residents.

What has the rateable value to do with it? Is it to show the less amount of wealth in your district?—That is so.

Do you find that rateable value has any direct ratio to the consumption of gas?—Yes. I think it obvious, so far as it represents the class of houses inhabited by the people. A house rated at £100 burns more gas than one rated at £20.

You put forward the fact that you have houses of a low rateable value as a reason why the consumption of gas is smaller?—Yes.

Have you had any increase in the number of your consumers?—From a table I will hand in, you will see that the ordinary private consumers in 1881 were 21,586, and in 1898 only 23,150. You will see that in 1890 there were 21,323 consumers—thus showing an actual falling off. This was partly through the docks. There were only 1564 consumers added in eighteen years.

That is what you call ordinary consumers; but if you take the working-class consumers by coin-meter supply?—We have added 9551 of them in the last six years. As the use of these meters became known, they were applied for in increasing numbers.

You have practically increased from 21,323 in 1890 to 32,701 consumers in 1898?—Yes. All that increase had been, however, in the supply of gas through prepayment meters. It is a poor consumption.

What is the population of your area?—The population is 470,000.

Have you only 32,000 consumers out of 470,000?—That is so at present. I may say there appears to be little or no limit to the extent of the increase with the working classes through coin meters. The figure of 32,000 represents houses supplied, though in some cases there are two persons paying for gas in one house. Thus the 32,000 would mean 150,000 or 160,000 persons probably.

By Sir F. DIXON-HARTLAND: The Commercial Company gave 25 cubic feet for 1d. through the coin-meters.

Further examined by the CHAIRMAN: The sale of gas per mile of main was under 8¼ million cubic feet in the case of the Commercial Company, as against 10½ and 10 million feet with the other two Companies. The number of consumers per mile of main was 109 with the Commercial Company, against 156 with The Gaslight and Coke Company, and 177 with the South Metropolitan Company. The greater part of the 177 South Metropolitan consumers were supplied by coin meters. Again, with regard to public lighting the Commercial Company had only 20 lamps in the streets per mile, against 24 in the case of the South Metropolitan Company, and 26 with The Gaslight and Coke Company. In the Commercial Company's district there were fewer public lamps per mile of main than anywhere else in the Metropolis. From 1886 to 1891, the increases of the Company's sale were very fluctuating—often very small; and from 1891 to 1894, there was an absolute decrease of nearly 3 per cent. Over the whole nine years, 1885 to 1894, the increase was only 291 million cubic feet, or 17 per cent.—a stagnation which was quite unique, as there was no special competition in lighting. This had operated unfavourably to the Company, because it had the effect of preventing them for a long time from introducing such improvements as might have been incorporated in the usual extensions of plant necessary over such a period; and thus hindered them from still further reducing the price of gas, which now was the lowest but one in London.

The CHAIRMAN: Do you say the price at which your gas is sold in the Metropolis is the lowest except one?

Witness: It is almost the lowest of all the large and important Companies throughout the kingdom. The only one which is lower is one of which I am a Director—the Wandsworth Gas Company.

What is your capital per 1000 cubic feet?—The ordinary capital of the Commercial Company is 8s. 3d. per 1000 cubic feet, or £425 per million cubic feet of gas sold.

Is that inclusive of the slot meters?—No. I am speaking of the ordinary capital, apart from that which we have to spend in connection with the coin meters. The coin meters each consume only from 10,000 to 15,000 cubic feet per annum, whereas the ordinary consumers take from 40,000 to 80,000 cubic feet each. The coin meters call for the expenditure of a good deal of capital, which is practically lent to the consumers at 4 per cent.

Your Company supply slot meters, do they not?—Yes; we lend the meter with all the internal fittings of the house, and very often a cooking-stove, on the hire principle. They pay so much for hire, and so much for depreciation; but in each case we have to spend from £4 4s. to £6 10s. This means finding an additional sum equal to, or slightly larger than, that which was necessary to build works and lay down mains and services to bring the gas to the houses—or about £400 per million cubic feet. The Company have to spend as much on fitting up the gas apparatus as the whole cost of working, manufacture, and bringing the gas through the streets to the doors of the houses. The consumption of gas through slot meters is not a very profitable one to the Company.

Have you raised any capital for this particular purpose?—Oh, yes.

You are having it repaid year by year?—Yes. We allow upon the meter fifteen, but on the fittings about twelve years. There is a risk of the latter going out of fashion—something else might spring up.

I think you want to make some statement about the price of your gas?—In 1874, the Commercial Company were charging 4s. per 1000 cubic feet; the Ratcliff (of which I was then Manager), 3s. 9d.; and the South Metropolitan, 3s. In 1875, the Commercial Company were the first to take up the sliding-scale, as now constituted; and they amalgamated with the Ratcliff Company, charging 3s. 9d. per 1000 cubic feet. Since that time, we have tried to get the price down; but we have generally charged 3d. per 1000 cubic feet more than the South Metropolitan Company—the difference being due to the inferior circumstances of the Commercial Company. The South Metropolitan Company are always my standard; my wish being to get the Commercial price down to theirs. From 1882 to 1890, we were able to get level with the South Metropolitan Company; but this was due to the fact that the South Metropolitan Company had recently amalgamated with two Companies whose circumstances were not as favourable as their own, and for three years they were handicapped. Since, however, the development in the South Metropolitan district, which has considerably increased the business of the Company, and enabled them to adopt all the latest improvements, they have got ahead; and last year they were 3d., and now they are 4d. lower. The present price of the Commercial Company is 2s. 6d. per 1000 cubic feet for private lighting, and 2s. 4d. for public lamps.

What is the reason that you have been able to come down from 4s. per 1000 cubic feet in 1874 to 2s. 6d. now?—In the first part of the time we did have growth of our business. The stagnation came at the period to which I have alluded. Then when we amalgamated our works were over-taxed, so we built new ones; and in building these new works we were able to spend our capital with great economy, and to provide for a large additional business with a very small outlay. In this way, we kept on reducing the charge. Again, we have been able to make gas a little cheaper by developing the output at the small works down by the river. There we get the coals cheaper than we can obtain them at the other works.

Sir A. SCOBLE: I wanted to ask whether, if your dividend charge had not been so high, you would not have been able to make a greater reduction?

Witness: Yes.

If you pay 7 per cent. on the capital, and 4½ per cent. on the debenture stock, that is very high, is it not?—Yes. The largest charge on gas is the interest on capital.

The CHAIRMAN: What is the dividend you are now paying?

Witness: We are paying 13½ per cent. on a small amount of original capital, 10½ per cent. on new capital, and 4½ per cent. on debentures.

Sir A. SCOBLE: Where does the 7 per cent. that you have just told us about come in?

Witness: It has been increased by the operation of the sliding-scale to 10½ per cent.

Sir F. DIXON-HARTLAND: According to the returns of the Board of Trade, you are paying 13½ per cent.?

Witness: Yes, on a portion of the capital.

What amount do you pay 13½ per cent. upon?—We pay 13½ per cent. on £550,000, 10½ per cent. on £200,750, and 4½ per cent. on about £200,000 debenture stock.

Then on the average you do not pay 13½ per cent?—Oh, no.

You pay 13½ per cent. on about two-thirds of your capital?—Yes. The total average is 11·4 per cent.

Further examined by the CHAIRMAN, witness said the sliding-scale operated in connection with all the Company's capital—old and new.

The CHAIRMAN: Then your standard price is 3s. 9d. per 1000 cubic feet?

Witness: Yes.

And your standard dividend is 10 per cent?—10 per cent. and 7 per cent. on the two different classes of capital; and those are added to by 3½ per cent. through the operation of the sliding-scale. I agree with Mr. Haward's statement that, under the sliding-scale, of every £100 the Company can save, £16 goes to the Company and £84 to the consumer.

Can you give us any reason why your price is now 2s. 6d. per 1000 cubic feet, and that of the South Metropolitan Company only 2s. 2d.?—They have reduced the price by 1d. in the present year. Generally the mean difference between us is 3d.; and I could get over that directly if my works were all down on the riverside. The difference is more than accounted for by the extra cost of getting coal unloaded at the riverside, loaded again to be taken to the works, and then delivered. This extra loading makes a difference of about 1s. 6d. a ton.

That is the reason you allege for the difference in price?—Yes. I could supply gas 3d. per 1000 cubic feet cheaper if I could bring the two works of the Company down to the river. Though I cannot transport them to the river, we are endeavouring to have ships built specially to pass round the tortuous bends of the River Lea, and thus bring coal direct to the works. We have had one or two large ships up there; but unfortunately they have knocked the bridges about. If this experiment should work out, I have the greatest hope of reducing the price of gas considerably.

Sir F. Dixon-Hartland: Is not the coal when transhipped injured to a certain extent?

Witness: Yes; to a slight extent, through being exposed in barges and to the air, and through possible leakage in the barge.

The Chairman: Have you anything to say with regard to the difference of price between your coal and the coal used by the South Metropolitan Company?

Witness: We buy our coal practically at the same price f.o.b. in the North; and all the expenses in the Thames are about the same, except that our works on the Thames have such a little wharf that we are obliged to have specially small steamers. We lose some 2d. a ton in this way.

Then you have something to say about the question of competition in coke I think?—Yes; we suffer a good deal from competition in the sale of coke. We do not show well in the value we get from our residuals.

Have you anything to say with regard to the question of the rectitude of the sliding-scale, the standard price, and the standard dividend which is imposed on your Company?—Yes. I may say no movement has operated so extraordinarily to reduce the price of gas as the sliding-scale.

Do you approve of the provision of the sliding-scale?—Yes, I do. We should never see gas sold at 2s. 2d. per 1000 cubic feet, as it is in Rotherhithe to-day, but for the sliding-scale.

Do you think that the sliding-scale, as far as your Company are concerned, wants any revision or alteration?—No; certainly not.

Sir F. Dixon-Hartland: I believe your principle is distinctly that to make gas succeed it should be sold as cheaply as possible?

Witness: Yes.

That is your principle—to get the price down as low as possible?—You can only get a large sale by cheap gas.

In further examination, witness said that, for some time his Company earned only 6 per cent. They paid higher dividends, however, by drawing on the reserve instead of raising the price. If they had not kept the price down, they would never have had the large sale they had now. The Company had very carefully considered the question of moving their works to the banks of the Thames, but had been unable to take this course because of the enormous expense; the whole bank now being occupied by works which would have to be purchased. It was for this reason they were having coal ships specially built. There was not much competition with the Company. Two Local Authorities had taken to electric lighting in the streets; but the installations were not yet in operation. A reason why the price of gas had not been further reduced was the poor sale they had for coke—due to the fact that in their district was sold not only the coke produced in the manufacture of gas for their area, but also that produced in the manufacture of gas at two large works of the South Metropolitan Company, which gas was not used for the district. The Company had therefore to meet a sale of coke double or three times what it would otherwise be; so that the price was affected by considerations which did not apply in most districts.

The Chairman: I understand you to mean that you have more competition with regard to the sale of coke?

Witness: Yes; it is a very keen competition. The cement makers, who take coke from Beckton, will not pay us at Bromley the price they give at Beckton, because this is farther up the river; and they insist on a reduction of 6d. This makes the coke, on the wholesale footing, at Bromley works 6d. cheaper than it is at Beckton. That is what I have to fight against. That is why my net cost of coal is 1d. per 1000 cubic feet more than it would be.

Examination continued: The net cost of coal, according to Mr. Haward was 7·78d. per 1000 cubic feet sold in the case of the Commercial Company; the figures for the other two Companies being 6·54d. and 5·46d. The competition of the South Metropolitan Company in the sale of coke was an extreme hardship on the Commercial Company. Another cause operating against the latter Company was the fact that they had to employ three separate works for a comparatively small total output; the reason being that the smallest works, which would otherwise be closed, was on the banks of the Thames, and was thus the cheapest for obtaining coals. But for the saving thus effected, these works would have been closed, in order to effect economy in the matters of staff, working expenses, &c. While the Commercial Company had three works for a total annual sale of 2341 million cubic feet, or 780 millions per works, the South Metropolitan Company had six works for a total output of 8844 millions, or 1440 millions per works (nearly double the scale of the Commercial Company); while The Gaslight and Coke Company had ten works for a total output of 21,022 millions, or 2102 millions per works (nearly three times the scale of the Commercial Company). Obviously, the staff and fixed charges, cost of administration, and dealing with labour, were much heavier on the smaller scale.

The Committee then adjourned until to-day.

Walsall Gas Supply.—The quarterly report of the Borough Auditor of Walsall on the accounts of the gas undertaking of the Corporation shows that the gas sold to private consumers produced a revenue of £14,645; being an increase of £701 on the receipts in the corresponding period of 1898.

The Walker Electric Lighting Order.—Last Thursday, the Bill to confirm a Provisional Order with respect to the lighting of Walker by electricity came before the Court of Referees; the point for decision being whether the Walker and Wallsend Union Gas Company and manufacturers and others in the urban district of Walker had *locus standi* entitling them to appear against the Bill in Committee. The Court having heard arguments by Counsel, decided to allow *locus* so far as the Company were concerned, but disallowed it with regard to the manufacturers and others.

HOUSE OF LORDS COMMITTEE.

(*Before Lord* Ribblesdale, *Chairman*, *Viscount* Falkland, *Lord* De Manley, *Lord* Wrottesley, *and Lord* Newton.)

LOUGHBOROUGH CORPORATION BILL.

In dealing with this Bill on Tuesday last, the above-named Committee arrived at a decision which will probably be regarded as an important precedent, and as carrying still further the principle adopted in the Morley case of last session. The object of the Bill was to empower the Corporation of Loughborough to compulsorily acquire the undertaking of the Loughborough Gas Company, to supply gas and electricity, and to extend their present water limits. The only part of the measure that was opposed was that relating to the gas undertaking, to which the Gas Company strongly objected.

Mr. Worsley Taylor, Q.C., Mr. Claude Baggallay Q.C., and Mr Frere appeared for the promoters; Mr. Balfour Browne, Q.C., the Hon. J. D. Fitzgerald, Q.C., and Mr. Moon represented the Gas Company.

In opening the promoters' case for the Bill, Mr. Worsley Taylor said that the Loughborough Gas Company had also introduced a measure by which they sought to raise £34,000 of additional capital, with the usual borrowing powers, which meant something like £11,000 more. The capital at present authorized was £40,000. The Corporation thought this was a suitable time at which to acquire the undertaking. The purchase was, under the Corporation Bill, to take place on terms to be agreed on, or, failing agreement, to be determined by arbitration under the Lands Clauses Act. The Corporation had no serious complaints to make against the Company; but they thought that, as a matter of public policy, they ought to be allowed to acquire the gas-works. There had, however, been complaints made by people in the town, in the midst of which the works were situated, as to the way in which they had been carried on. Mr. Stevenson, the Corporation's adviser, had been refused access to the works, and therefore he could not say precisely what was wrong; but he thought there must be some defect in the working of the purifiers. As the town was growing, it might be necessary at some future time to remove the works to a more suitable site. In this event, he need hardly say that the Corporation would be more amenable to public pressure than the Company. Another complaint made against the Company was that for a period of years, though their attention had been called to the matter, they had paid income-tax on their dividends, which they had no right to do. It was calculated that this payment was equivalent to something like 1d. in the pound on the price of gas. Again, in some cases the Company's mains had been laid with insufficient cover; and, as a consequence, there had been trouble with regard to leaking joints. The Corporation also considered that the works had not been as economically managed as they might have been. The average quantity of gas sold per ton of coal carbonized was 10,000 cubic feet; but the Loughborough Gas Company's figure was only about 8000 cubic feet. Then the Corporation thought that the Company had starved their works, and that they had favoured revenue at the expense of capital. They had spent £15,000 on the works out of capital since 1886; the bulk of it between 1886 and 1894. Of course, this expenditure ought to have resulted in an increase of business; but, as a matter of fact, the sale of gas in 1894 was substantially the same as in 1888. The learned Counsel proceeded to read the Company's petition, in the course of which they stated that the undertaking had been well managed; that the charges were low; and that it would be unfair to their shareholders to force them to sell the concern. Further, they submitted that gas and electricity, being rival illuminants, ought not to be placed under the control of the same authority; as, if they were, the public would lose the benefits of competition.

The first witness called for the Corporation was Mr. J. Jarratt, Town Clerk of Loughborough, who stated that there was a very strong feeling in the town in favour of the acquisition of the gas-works by the Corporation. For years the matter had been made a test question at the municipal elections. In March last, he wrote, on behalf of the Town Council, to the Company, suggesting that they should sell by friendly arrangement; and the reply he received was that the Directors had unanimously resolved that they had no desire to enter into negotiations with the Corporation. Later, the Company declined to permit the Engineer advising the Corporation to look over the works. The Council felt strongly that they were entitled to have absolute control over the streets of the town, with regard to the laying and repairing of gas-pipes and mains. In cross-examination, witness admitted that the price of gas in Loughborough was very low—being 2s. 10d. per 1000 cubic feet to ordinary consumers, and 2s. 5d. to the Corporation.

Alderman Bumpus, Chairman of the Parliamentary Committee of the Council, said that, while the Corporation were strongly of opinion that the lighting of the town ought to be in their hands, they did not want to take advantage of the Company in any respect, but desired to pay them the full value of the undertaking. The Corporation could borrow money more cheaply than the Company—namely, at 3 per cent. Of course, another 1¼ per cent. would have to be added for the sinking fund; but at the end of the period fixed for repayment of the money borrowed, the works would be paid for.

Mr. A. H. Walker, Borough Surveyor and Engineer of Loughborough, said he had, of course, seen a good deal of the Company's mains. They were rather dilapidated, and showed signs of considerable leakage. They were generally laid at a very shallow depth; and he had known instances in which they were only 11 inches below the surface. In December, 1897, he wrote to the Company suggesting that they should supply the public lamps with incandescent lights. The only answer he had received up to the present was that they were considering the matter. He expressed the belief that there would be a saving in the cost of repairs if water and gas mains could be laid at the same time, and under the same direction. It was not the custom to lay water and gas mains in the same trench; but if the two trenches could be opened and filled up at once, there would be a saving in regard to the making up of the road. Witness admitted that the Gas Company had been reasonable people to deal with, and had done their work pretty well.

Mr. Faulks, Chairman of the Lighting Committee of the Town Council,

and Mr. E. H. Stevenson having given evidence, Mr. Alfred Colson expressed the opinion that it was of great advantage to the community that gas and electric lighting undertakings should be in the hands of one authority, as one set of offices, and to a certain extent one set of officials, sufficed for the two departments.

Mr. Balfour Browne, on behalf of the Company, said he would not call any witnesses, but would simply ask the Committee to throw out the Bill. No ground whatever, he said, had been shown for asking the Company to part with their property against their will. He admitted that even a statutory Company, like the Loughborough Company, might be expropriated, if it could be shown that they had not done their duty to the public; but he pointed out that this had not been said, and could not be said, of the Loughborough Company. Indeed, Mr. Worsley Taylor had admitted that he had no serious complaint to make against the Company. He only knew of a single case in which the undertaking of a Statutory Gas Company had been transferred against the will of the Company to a Local Authority. He referred to the Morley case, which was decided last session. In that instance, however, serious complaints were made against the Company. It was not a case in which a Corporation merely said: "Here is a Company, let us eat it up;" but one in which the Company were in default, and also one in which they were practically willing sellers. This was the only instance in which Parliament had hitherto allowed an undertaking to be purchased against the will of the Company. On the other hand, there were innumerable cases of the rejection of Bills of this character. He might say that he doubted the wisdom of placing lighting undertakings in the hands of Public Authorities. The Gaslight and Coke Company of London, had been badly hit by the competition of Electric Lighting Companies; and the same experience might fall to the lot of gas undertakings which were in the hands of Local Authorities. Was it wise to subject the ratepayers of a town to the risk of losing heavily owing to the competition of some new illuminant? He might also point out to the Committee that if it was to become a matter of public policy that every Gas Company might be expropriated whenever a Local Authority desired to purchase, it would be impossible in the future to induce capitalists to invest in such undertakings—knowing, as they would, that whenever the concern was on the point of paying, the Local Authority would take over and appropriate the profit.

Mr. Worsley Taylor, having obtained permission to reply to Mr. Balfour Browne's remarks on the question of precedents, said that his recollection of the Morley case (in which he, like Mr. Balfour Browne, was engaged) was not the same as that of his learned friend. His own recollection was that there was no substantial ground of complaint against the Morley Gas Company, except that they had not properly consulted the convenience of the public respecting the relaying of the streets.

Mr. Moon said that he was also in the Morley case; and his recollection confirmed that of Mr. Balfour Browne.

The Chairman intimated that the Committee did not attach much importance to the conflicting recollections of Counsel on the Morley Bill, as they intended to decide the present case on its merits.

After deliberation in private, the Chairman said the Committee were of opinion that the Bill might proceed.

Mr. Moon said that this decision would make it unnecessary to proceed with the Gas Company's Bill.

On Wednesday, the Committee adjusted the clauses of the Corporation Bill, approved the preamble, and ordered the measure to be reported to the House.

HOUSE OF LORDS COMMITTEE.

Friday, May 5.

(*Before Lord* Ribblesdale, *Chairman*, *Viscount* Falkland, *Lord* De Mauley, *Lord* Wrottesley, *and Lord* Newton.)

METROPOLITAN WATER COMPANIES BILL.

This Bill, which has been passed by the House of Commons (*ante*, p. 1054) to-day came under the consideration of the above-named Committee.

The Hon. J. D. Fitzgerald, Q.C., and Mr. Rickards appeared for the promoters. The opponents were represented as follows: The Hertfordshire County Council, by Mr. Wedderburn, Q.C., and Lord R. Cecil; the London County Council, by Mr. Balfour Browne, Q.C., Mr. Worsley Taylor, Q.C., and Mr. Freeman, Q.C.; the Metropolitan Water Companies, by Mr. Pope, Q.C., Mr. Littler, Q.C., Mr. Pember, Q.C., and Mr. Claude Baggallay, Q.C.; the Corporation of London, by Mr. Rigg; the Trustees of the late Mr. William Bailey, by Mr. F. T. Squarey.

In opening the case for the promoters, Mr. Fitzgerald said the object of the measure was to carry into effect the first report of the Royal Commission on the water supply of London now sitting. The Bill was promoted by the Government, with the special object of preventing the recurrence in London of what took place last year, when for a long time during the autumn there was a scarcity of water in the East-end, causing very considerable inconvenience and distress to a large number of inhabitants. At that time the other Metropolitan Water Companies, or some of them, were in possession of a considerable surplus supply; and had these surplus supplies been immediately available for the relief of the East London Company, the inconvenience and suffering which had been occasioned would either have been avoided altogether or, at all events, considerably mitigated. The Bill was promoted to carry out this object. It was not a Bill either for authorizing or requiring the Companies to obtain new sources of supply, but to enable and require them to use their existing sources to meet any case of emergency in another district. The whole matter had been gone into fully, and evidence had been taken and considered by the Royal Commission. This being so, the report of the Royal Commission was really the evidence for the Bill; and he would at once turn to the report, and direct attention to the material parts of it, to show what the recommendations of the Commissioners were, and how the promoters proposed to carry them out.

The Chairman: When you say the Commissioners have gone into the whole matter, you mean they only went into the emergency question, as to which they were asked to hurry up.

Mr. Fitzgerald said the Commission were sitting to inquire into the whole water question. They had taken evidence on the entire question; but their first report was limited to this particular matter. One of the objects of the Commission was to consider "whether it is practicable to connect any two or more of the different systems of supply now administered by the eight Metropolitan Companies; and, if so, by whom, and in what proportion, should the cost of connecting them be borne, and what are the legal powers necessary to give effect to any such arrangement." With regard to this question, the Royal Commission had submitted their report. The first paragraph of the report set forth the proposals made by the Associated Water Companies; and these were really, in the main, accepted by the Royal Commission. Paragraph 2 gave the details of three schemes which were submitted by the Engineers of the Water Companies; but the Commission had not suggested that any one of the particular schemes should be made the groundwork of a Bill. They rather had proposed that the measure to be introduced should be of an elastic character, giving the necessary power to deal with any case of emergency. The third part of the report dealt with the present capacity of the Companies to contribute water, and pointed out the powers they possessed, and to what extent these powers were utilized. For instance, in the case of the Chelsea Company, they possessed powers to abstract 22 million gallons per day from the Thames, but only took 17 million gallons; leaving a surplus of 5 million gallons. In the same way the report dealt with the other Companies, some of whom had no surplus. The East London, of course, had a deficiency. The surplus possessed by the Companies amounted to from 20 to 23 million gallons a day, which could be made available for the relief of any Company having a temporary deficiency. The report dealt with the present position of the East London Company, and the measures necessary to secure continuity of water supply in the event of drought. It pointed out what took place last year; the deficiency to some extent being met by obtaining a supply from the New River and Southwark and Vauxhall Companies. He thought that altogether something like 790 million gallons were contributed to the East London by the other Companies who were able at the moment to give temporary relief. The report pointed out that something of the same sort, or possibly going further, would be necessary in the present year. Part 5 of the report gave the views of Directors and Engineers regarding the expediency of adopting a general scheme of intercommunication; and Part 6 had reference to the objects to be gained by connecting the systems of supply. In paragraph 29, they said: "Under a system of general intercommunication of all the works of supply, if occasional miscalculation, neglect, or accident occurred in the case of any individual Company, the result would be that, instead of a partial failure of supply taking place, with more or less inconvenience and distress to the inhabitants, the Company could apply to others, and receive from adjoining districts whatever assistance was required. After such a proof of their incapacity to supply the wants of their district unaided, the defaulting Company should be compelled, if necessary, to proceed without delay to extend their works, or to remedy any defects which might have been shown to exist. Meanwhile, the ability of other Companies to transfer water into the district of the defaulting Company would safeguard the population from the loss or diminution of their water supply." Part 7 contained observations on the schemes of intercommunication submitted by the Associated Companies; but, for the reason he had stated, the Bill did not proceed on the lines of sanctioning any particular set of works. Therefore it was not necessary to go into detail as to the report. The last part of the report contained the recommendations. It dealt with the cost of intercommunication schemes, and the necessary legal powers. First the Commissioners pointed out that the Associated Water Companies, taking a general view of the situation, were willing, and themselves proposed, that the cost of constructing the necessary works should be borne by the Companies—regarding the matter, as it were, in the light of an insurance by each Company—the particular Company receiving benefit for the moment paying an additional proportion to the common fund. Paragraph 37 contained a point of some importance, because it was raised in the petitions: "It was contended before us, on behalf of the Companies, that, inasmuch as the money raised by issuing the debenture stock could not yield revenue or profit to the Companies, the sinking-fund clauses, which are founded on the assumption that debenture capital is expended so as to produce revenue and profit, were not applicable. We think that there is force in this contention; and that this debenture stock might be exempt from the obligations of the sinking-fund clause." The Bill had been framed to carry out this view. In the next paragraph, the Commissioners said: "It was urged by the London County Council that the effect of any scheme of intercommunication might be to increase the value an arbitrator would put upon the undertakings of the Companies, in the event of purchase by some public authority. We doubt whether this apprehension is well founded; but we think that in any case all doubt on the subject should be removed, and that no Company should be allowed, in the event of purchase, to enhance the value of their undertaking by reason of an intercommunication scheme. Such a scheme is intended, not to result in any profit to the supplying or receiving Companies, but to protect the water consumer from inconvenience, which may no doubt be sometimes the result of mere accident, but which is mainly due to the default of some Company in making due provision in proper time for all the appliances necessary to keep up the full supply for which they receive payment in water-rates. We think, therefore, that a clause similar to section 84 of the Staines Reservoirs Act, 1896, should be inserted in the Bill by which any intercommunication scheme is authorized." This had been done. Paragraph 39 of the report was the only other one he need read: "We have adverted above to the fact that the works proper to be undertaken for the purpose of connecting the systems of supply of the eight Water Companies, and the order in which those works should be executed, require further consideration. It appears to us that it would be inexpedient to lay down any complete scheme in the Bill which must be passed to render intercommunication possible, and which ought to be passed with the least possible delay, in order to meet the contingencies of next summer. It will be better to frame elastic clauses enabling the Companies to execute from time to time such works for the purpose of intercommunication as may be authorized by a public department, such as the Local Government Board. In order to guard against possible dilatoriness on the part of the Companies, it will be useful to enact that they shall be bound to execute with all despatch any works which the Local Government Board may authorize, or may direct on their own initiative. Powers and clauses of that character will enable

the works urgently necessary to be executed at once; while the extension of the scheme of intercommunication may be the subject of further consideration. It will probably be found convenient in practice that any work establishing a communication between two Companies, and extending into the districts of both Companies, should be entirely executed by one of the Companies. The Companies might therefore be usefully empowered to execute these works both within and without their district of supply." These were substantially the recommendations of the Royal Commission; and the Bill had been framed in the shortest and simplest way possible to carry out these recommendations. Turning to the petitions, the only one against what he might describe as the preamble of the Bill was that of the London County Council. Paragraph 5 of this petition said: "Your petitioners understand that the present Bill has been proposed as a temporary measure of protection against deficiencies of water supply to which particular districts of London have been subject, and not as a measure to affect the more important questions which are pending between your petitioners and the London Water Companies with respect to the transfer of the undertakings to a Public Authority, and the terms of such transfer." That was perfectly correct. The petition, however, went on to say: "But your petitioners submit that if the Bill be passed in its present form, it will confer powers which will permanently and materially alter the position of the Water Companies in their relations to Parliament and the public." There was nothing in the Bill to cause such apprehension. They said: "The effect of the Bill would be to withdraw from the direct control of Parliament, and to relegate to the decision of a Department of State, those important questions with respect to the extension of the Companies' works and capital powers, in respect of which they have heretofore been subject to Parliament. All the relations between the Companies and the public have been regulated by a long series of carefully considered enactments, under which during recent years the interests of the public have been protected; and while your petitioners do not object to powers being conferred on the Local Government Board to secure and enforce the fulfilment of statutory obligations, your petitioners object to the provisions of the Bill under which the Companies will be enabled to exercise new and undefined powers of making works and of raising capital without resort to Parliament." The whole object of the Bill was to meet cases of emergency, and to enable the existing supplies of the Companies to be utilized for the assistance of neighbouring Companies. The petitioners went on: "Your petitioners have, in pursuance of recommendations of Committees of Parliament, applied, by a Bill now pending, for powers to purchase the undertakings of the eight Water Companies, in order that the works and systems of supply may be consolidated and adapted to meet the general requirements of the public interest, instead of being carried on as at present with a view to the separate financial interests of eight separate Companies carrying on the business of water supply as a matter of commercial profit." The Bill did not affect the question of the purchase of the Water Companies at all. The measure was based on the report of the Commission; and this report, in paragraph 42, said: "We regard the suggestions and recommendation in this report as entirely independent of the other matters referred to us, and as in no way prejudicing the question of purchase of the Companies' undertakings by one or more Authorities, or the question of control to be exercised by Local or other Authorities, upon both which questions we are prosecuting our inquiry." In paragraph 8, the petitioners set out the matters referred to the Commission; and in paragraph 9 they said: "Your petitioners point out that unless the Companies' undertakings are purchased within the period of seven years fixed by the Bill, the scheme of this Bill appears to involve the grant of a new concession to the eight present Water Companies, by placing them upon a new footing with respect to supply of water"—the whole of the Staines reservoirs scheme had been put in the Bill, and it was not correct to say that the Bill involved a new concession—"and your petitioners submit that, if any new rights are to be granted to the Companies, it would be reasonable and expedient in the interest of the public that the existing relations between the Water Companies and the consumers should be thoroughly revised, with a view to the public advantage and the adoption of the lowest standard scale of rates." The scale of rates now charged by the Companies and the relations of the Companies with the public were entirely outside the purview of the Bill. It was never intended that they should be dealt with in the Bill; nor were they dealt with in the report of the Royal Commission. In paragraph 10, they said: "Your petitioners, therefore, submit that any power given, either to the Local Government Board or to the Water Companies, under the present Bill, should expire at the end of some definite period to be named in the Bill." If it were certain that no emergency would arise at the end of the definite period, there might be something in that. But as an emergency might arise at any period, as one arose last summer, it was necessary, if the Bill was to be effective, to make it cover any period within which an emergency might arise. Paragraphs 11, 12, and 13 set out what was really part of the case of the County Council against the Water Companies, as to the purchase of their undertakings by a Local Authority. They referred to the different charges which were made in the various districts; but, so far as he could see, these matters had nothing whatever to do with the Bill. The only effect of the passing of the Bill would be to get rid of the deficiency in the East-end, and to give the consumer a full supply of water at the same rate that he had to pay for a very limited supply last summer. The petition went on to say: "Your petitioners submit that clause 2 of the Bill is unnecessary, and open to considerable objection. The terms and conditions under which the Metropolitan Water Companies have been empowered by Parliament to raise additional capital or to issue debenture stock charged upon their respective undertakings, have been from time to time fully discussed before Committees of Parliament. Your petitioners humbly submit that, having regard to the strong feeling among the ratepayers and consumers of water in London that the undertakings of the Companies should be promptly acquired on behalf of the public, no further pecuniary charges on these undertakings ought to be sanctioned otherwise than under the authority of Parliament." If these works were to be carried out as proposed by the Bill, by order of the Local Government Board, it was necessary that power should be given to the department to sanction new issues of capital for the purpose; otherwise there would be a delay of a year in obtaining capital powers in every case. The petition continued: "Your petitioners further strongly object to the proposal of clause 2 to set aside the provisions which have been enacted by Parliament with respect to the provision of a sinking fund as against capital expenditure." As this expenditure did not involve any additional profit, the sinking-fund clause ought not to be applied to it. The petition next said: "Your petitioners would most humbly submit that the Bill, if found to be necessary at all, should be limited to the authorization of such works as are immediately necessary for the prevention of scarcity of water in London; and that it should be of a temporary character only." The other petitions he need not go into in detail. That of the Corporation dealt substantially only with the sinking-fund proposal of the petitioners. The petition of the Water Companies asked to have certain amendments introduced into the measure, which would be dealt with on clauses. As at present advised, he did not think that any of the amendments were required, with one exception, and this he could not accept in the words in which it stood. The fourth petition was that of the Hertfordshire County Council. There were a great many points raised in this petition; but really what they were apprehensive about was that the pumping of water from deep wells in the county of Herts by the New River and the East London Companies would involve hardship to the inhabitants of the county. They were desirous that no power should be given to the Companies which would enable them to sink wells in the county and take more water by this means than they did at present. He did not believe the Bill would confer any such authority; but the petitioners had been advised that the measure as drawn, in conjunction with other powers which the two Companies possessed, would do so. The Bill was not intended to confer such power; and if on examination there was any reasonable doubt as to the meaning of the Bill, he agreed that something should be done to protect the Council.

Mr. Worsley Taylor said his learned friend had adopted the same remarkable procedure as he had in the House of Commons. His doing so took him (Mr. Worsley Taylor) by surprise. The ordinary practice in both Houses, according to his thirty years' experience, was that, after the case had been opened, both for the benefit of the Committee and in justice to the opponents, the Counsel for the promoters should call evidence to prove the preamble of the Bill. The practice was convenient as affording information to the Committee, and just to the opponents as enabling them to get out a portion of their case by means of cross-examination of the promoters' witnesses. In this instance, his learned friend had put down on the table a Blue-Book, and had explained such portions of it as he had thought fit. He (Mr. Worsley Taylor) did not know whether their Lordships had had an opportunity of reading the Blue-Book, and how far they were informed.

The Chairman, after consultation with the Committee, said the Bill was a Government measure, based upon the report of a Commission. The Committee thought the opposing Counsel would be able to lay before them all the points they wished to make against the Bill, without cross-examining witnesses for the Bill.

Mr. Worsley Taylor then proceeded to give an exhaustive review of the London Water Question from the point of view of the London County Council. He referred to Sir William Harcourt's Committee, and to that of Sir Matthew White Ridley—pointing out that the report of the latter declared that they had proceeded upon the assumption that, in the opinion of Parliament, it was desirable to establish a central public Water Authority in the Metropolis, and that they had recommended that the London County Council should be empowered to investigate the whole subject of the Metropolitan Water Supply, and to promote Bills. He described how effect had been given to this report in 1892 by Parliament; the Council receiving the powers which the Committee had recommended should be given to them. He touched also upon the work of the Royal Commission presided over by Lord Balfour of Burleigh. He next dwelt upon the decision of the Council that the only real solution of the question lay in the purchase of the water undertakings, and upon the attempt they had made to give effect to this decision by legislation. At the outset of the attempt, the Chairman of the Committee to which the County Council Bill was referred had said that they were not going to consider whether there ought or ought not to be purchase, as they thought they were bound by the reports of previous Committees. They announced that they took purchase as a conclusion already come to by Parliament, and that they accepted it as the basis of what was to be done in the future. Of course, they had left open the question as to who was to be the Water Authority, and as to what the terms of purchase were to be. A long inquiry took place on the question of these terms; and he ventured to say that all sides had now arrived at a very substantial agreement. In 1896, the Government had brought forward a Bill, known as the Metropolitan Counties Water Board Bill, which was to constitute a Joint Board for the purpose of taking over the undertakings of the Water Companies. The President of the Local Government Board had enunciated the same principle of purchase or control; and a promise was given that the Government Bill would be pressed on with all convenient speed. As a matter of fact, the Bill was introduced into their Lordships' House, but was no further proceeded with. The Bill died, and as the proposals of the County Council were suspended while the Bill was under consideration, they died also. Meanwhile, an incident had occurred which had shown the desirability of proceeding rapidly with the settlement of the question—viz., the East London water famine. The Council in 1897 re introduced their Bill, but were met by another obstacle which was fatal to their scheme; for the Government of the day took steps to procure the appointment of a Royal Commission. This Commission were instructed to inquire, first, as to purchase; and, secondly, as to control. The attempts of the Council to obtain legislation had been frustrated; but he asked the Committee to recognize as the basis of his argument that Parliament had acknowledged that the subject should be dealt with, and that it was an urgent matter. The learned Counsel then referred to the measures introduced during the past year or two by the Water Companies for the extension of their undertakings: and to the instruction given to the Committee of the House to the effect that it was clear that at no distant date the water question would be dealt with either by purchase or control, and that it was not right that the Companies should get fresh powers which would prejudice either of these questions, or that they should get more powers than would tide them over present necessities. It was under these conditions that the present Bill was introduced. Its object was to afford temporary relief to one Water Company; and clearly nothing should be done in it which would prejudice either of the questions referred to. The relief of the East London Company was to be effected by Scheme No. 3 contained in the report of the

Commissioners, which was as follows: "The third scheme is in effect a portion of Scheme No. 2, and has already been partially carried out, and put into operation to meet the emergencies of the present year. It was suggested by Sir Henry Knight as being quite sufficient, if completed, to meet the case of a drought similar to that of last year, if it should occur in the immediate future. This was on the assumption that no Company except the East London would be affected by such an occurrence; and no doubt the experience of 1898 justifies that assumption. The various contributions of water which could shortly be made available, according to Sir Henry Knight, in aid of that Company, if required, are as follows: The New River Company, 6 million gallons per day; the West Middlesex and Grand Junction Companies, 3 million gallons; the Southwark and Vauxhall Company, 10 million gallons; the Kent Company, 2 million gallons; and the Chelsea Company, 3 million gallons—or a total of 24 million gallons per day. The additional works necessary in order to secure the above supply were stated to be a main from Nunhead to the Thames Subway, and connections between the Kent and Chelsea mains and those of the Southwark and Vauxhall Company. It would, however, be necessary to add to these items a 24-inch main from the Campden Hill reservoirs to Poland Street. The total cost of these works, as stated in the report of Scheme No. 2, would be about £64,000." He was content to stand on this as his learned friend (Mr. Fitzgerald) was content to stand on the report of the Royal Commission. According to this distinct finding, the necessary work was to be effected at a cost of £64,000. Deal with this matter, and they would be dealing with the urgent part of the London water problem. The Bill ought to be limited, and carefully limited, to dealing with this purpose, and no other. If the measure went outside this specific necessity, and prejudiced the whole question of purchase, and the even more difficult question involved in control as a permanent thing, it sinned against that upon which it was based—viz., the report of the Royal Commission. The learned Counsel then argued for a limit to the duration of the measure of seven years. The Bill was at present so extended in its scope and duration, that it would seriously prejudice the question of purchase when it came to be considered in future years. He submitted that a sinking-fund clause should be inserted. Such a clause appeared in all other Acts contemplating the extension of the undertakings; but the Committee were asked, in a Bill for a temporary purpose, to depart from traditional policy. He contended that what had been done in this matter since 1886 should be insisted on. Then the question of the price at which the water under the Bill was to be sold to the consumers was important; and he urged the Committee to say that the charge should not be raised above the normal rate. He hope that the preamble would only be passed on condition that the scope of the Bill as to locality should be limited, and that the powers of each Company should be restricted to dealing with their own district or that of some other Water Company; that the Companies should first of all apply to the purposes of the Act capital which they were already authorized to raise (and if this were done, it would naturally follow that the sinking-fund clause would operate); and that if it were proved to the satisfaction of the Local Government Board that they had no such capital, they might raise money by the creation of additional stock subject to, and in accordance with, the most recent Act authorizing the creation and issue of such debenture stock. In the latter case, again, the sinking-fund would automatically come in. He would also ask the Committee to provide that the aggregate amount to be expended under the Bill should not exceed £100,000; that nothing in the Act should be deemed to prejudice the transfer of the undertakings to a public authority; and that the Act should only remain in force for seven years. These were the principles he wished the Committee to lay down as a condition to the passing of the preamble. If the Committee should think that the measure ought to be a permanent one, he would ask that a clause should be inserted stating that when one Company supplied another with water from the Thames or the Lea, the Associated Water Companies should not be able to charge any higher rate to their consumers than that now levied.

The Chairman said the Committee were not inclined to open the question of locality. The most important point seemed to be the limitation of time in the Bill. He did not think it necessary to hear evidence on behalf of the opponents. It was a Government measure, coming before the Committee with the *imprimatur* of Her Majesty's Ministers.

It was here announced that a clause had been agreed upon relating to the opposition of the Hertfordshire County Council.

On behalf of the petitioning Water Companies, it was stated that if there was no alteration of the principle of the Bill they would not take part in the discussion until clauses were reached.

Mr. Fitzgerald objected to the proposals for the limitation of time and capital. He pointed out that, in the event of a prolonged and unexpected drought, emergency might arise in the case of any one of the Companies. Having regard to increasing population and area, works might be required in the future which were not called for now; and if the powers of the Bill had expired, there would be no possibility of the Local Government Board ordering, or of the Companies carrying out, such works. It would clearly impair the usefulness of the measure if it were to be limited to seven years; and from the beginning to the end of their report the Royal Commission had made no such suggestion. It was their view, obviously, that the measure should be a permanent one, dealing with emergencies whenever they arose. As to capital, the case of the opponents was that the Commission had recommended a scheme which would cost only a little over £60,000—a scheme for meeting the single case of the East London Company. But the report suggested nothing of the kind. There was no departure in the Bill from the ordinary principle of raising money. The Committee were asked to authorize the raising of a sum limited to the purposes of the works under the Act. It could not be applied to any other object, and could only be raised with the consent of the Local Government Board. These were two most satisfactory limitations. It was the commonest thing to give Local Authorities power to raise whatever capital the Local Government Board might sanction.

The Chairman, after the Committee had deliberated in private, said they were of opinion that the Bill might proceed subject to the insertion of a sinking-fund clause.

Mr. Pember applied to the Committee on behalf of the Water Companies for an indemnity clause; money having already been expended to advance intercommunication. With regard to a sinking-fund clause, he submitted that it would, if inserted, be an alteration of the Bill, and would prove disadvantageous to the Companies for whom the measure had been introduced.

The Chairman: I thought the Bill was introduced for the benefit of the public.

Other Counsel having been heard, the room was again cleared. On the re-admission of the public,

The Chairman said the Committee were of opinion that the proviso to clause 2 of the Bill should be omitted, and that the sinking-fund clause should be inserted in that place.

After some discussion between Counsel as to the framing of the sinking-fund clause,

The Chairman said the Committee would not be satisfied with the clause unless it made it clear that the Bill was subject to the sinking-fund arrangement which had been in every Bill since 1886.

Ultimately the matter was left over for a clause to be agreed upon between the parties.

Mr. Wedderburn then proposed the insertion of the following amendment to clause 4, which he said had been agreed upon between the Government and the Hertford County Council: "Nothing in this Act shall authorize the construction by any Metropolitan Water Company of any works in the county of Hertford outside the water limits of the Metropolitan Water Companies."

Mr. Littler, for the Associated Water Companies, strongly opposed the amendment. It was of a protective nature; and there was the strongest objection to such provisions unless there were good grounds for them. There was not a word in the Bill about sinking wells. Hertfordshire for some years had persistently tried to get something put into some Bill with reference to the grievance they thought they had, because the Metropolitan Water Companies exercised in the county the right—which they had in common with every individual—to sink wells and draw water on lands acquired by them. The question had been discussed since 1887 without anything being placed in any Bill; and now this clause was brought up, and was said to be agreed upon between the Government and the county of Hertford. If the clause were put in, it would be quoted as a precedent, and would put the Companies to enormous expense.

Mr. Fitzgerald said it was not known that the Companies would object to the clause, which would not affect them in the least. A contest had been going on between two of the London Water Companies and the Hertfordshire Authorities. These Companies had been pumping a very large quantity of water from their wells in the county; and the people of the county resented it as a grievance. There was nothing in the Bill authorizing the construction of new works. Yet there were powers conferred on the Metropolitan Water Companies for the purpose of the Bill, which, if used in conjunction with existing powers, might enable the New River and East London Companies to do what they could not do at present—namely, to sink wells in Hertfordshire outside their district, and connect these wells by mains with their existing works. It would be conferring a power on the Companies to sink wells and obtain a new supply from Hertfordshire. At the present moment, if the New River Company sank a well in their own district there was nothing to prevent them taking water from it; but if they went outside their district, though they might purchase land and sink a well, they had no power to lay pipes and mains, and therefore it would be impracticable for them to use the well. Under the present Bill, however, the New River Company might claim that the power to lay mains was conferred upon them; and that would be a new power. It was not intended to alter the *status quo* by the present Bill at all; and as there was a possibility owing to the framing of the Bill that something of this sort might be done, it was thought only reasonable to meet the objections of the Hertfordshire County Council by stating specifically that the Bill was not to authorize any Metropolitan Water Company to construct works outside their limits.

Mr. Littler pointed out that a similar clause had been twice before a Committee presided over by Sir J. Pease last week, and rejected. The Bill simply enabled the Companies to supply water to their neighbours, in case of emergency, from any source they might be entitled to draw it from for the time being.

The Committee declined to allow the amendment of the clause asked for.

Mr. Wedderburn then asked for a clause declaring that nothing in the Bill should authorize the Companies to draw from any new sources of supply outside the limits of their district for the purposes of the Bill.

The Chairman inquired if Hertfordshire sought to put itself in an exceptional position to other counties—Middlesex or Buckingham, for instance.

Mr. Littler remarked that Hertfordshire was always asking for particular treatment; but if any alteration was to be made, it should be in the general law.

The Chairman said the Committee would be stultifying themselves if they assented to the proposal.

The Bill was then disposed of, with the exception of the sinking-fund clause.

Monday, May 8.

Lord R. Cecil, for the Hertfordshire County Council, referring to what passed at the last sitting of the Committee, said that, in bringing up the clause providing that nothing in the Act should authorize a Company to draw from any new source of supply beyond the limits of their district, Mr. Wedderburn had not sought to introduce a similar clause to that rejected by the Committee. The Committee had taken the objection that it was not fair for Hertfordshire to have special exemption. This was fully realized; and the clause was a general one. Owing to the course of events on Friday, Hertfordshire had not been heard. It was understood that some protection would be given by the promoters to the county; and therefore Hertfordshire did not press its case as it otherwise would have done. The agreed amendments were, however, on the objection of the Water Companies, rejected by the Committee. He now asked to be heard upon a general clause, which would also protect Kent and other counties.

Earl Cowper, called and examined by Lord R. Cecil, said he was present in the House of Lords on the second reading of the Bill. He heard Lord James say that Hertfordshire was not in the smallest danger; that the Bill would not confer powers to draw more water than was at present taken; and that if there was any doubt on the matter, it could be set right at a later stage.

Mr. Baggallay, on behalf of the Associated Water Companies, having

intimated that he must object to the insertion of any such clause as was now asked for, as being wholly irrelevant, an adjournment was asked for on behalf of the Local Government Board so that the matter might be looked into.

The Chairman said that before considering the insertion of any clause such as was proposed, the Committee must be satisfied that the President of the Local Government Board had assented to it.

Mr. Freeman then brought up a sinking-fund clause for insertion in the Bill, which he said was similar to that which had within the last few days been inserted in the Bill of the West Middlesex Company, but made to apply to the several Companies interested instead of one.

The clause was inserted.

Tuesday, May 9.

At the conclusion of other business to-day, Mr. Boyce, representing the Local Government Board, said he had placed before Mr. Chaplin the question of a general protective clause in respect to the sinking of new wells outside the Companies' area of supply; but the right honourable gentleman had not seen his way to agree to any further amendment of the Bill.

The Chairman: Under these circumstances, we must stick to what we said last night, and not put anything in.

Lord R. Cecil: You think it is not necessary to hear me on the point?

The Chairman: No.

Lord R. Cecil: Nor to hear evidence?

The Chairman: Nor hear anything. I think it was made absolutely clear that, unless any alteration had the *imprimatur* of the Local Government Board, the Bill must remain absolutely as it was.

The clauses were then adjusted, and the Bill was ordered to be reported to the House.

HOUSE OF LORDS COMMITTEE.

(*Before Lord* Loch, *Chairman, the Earl of* Carnwath, *the Earl of* Romney, *Lord* Colchester, *and Lord* Wandsworth.)

CHURCH STRETTON WATER BILL.

This Bill, the object of which is to incorporate the Church Stretton Water Company, with a share capital of £30,000, to construct works for the supply of water in the parish of Church Stretton, came before the above-named Committee on the 25th ult.

Mr. Claude Baggallay, Q.C., and Mr. Crossman appeared for the promoters; Mr. Graham represented the Church Stretton Rural District Council, the principal petitioners against the Bill.

In opening the case, Mr. Baggallay said the object of the promoters of the Bill was to supply the parish of Church Stretton with water; and, in order to do this, to incorporate a Company with the necessary authority. The parish was situated on the joint line of the London and North-Western and Great Western Railways. The water which was to be obtained in the neighbourhood was of very good quality; but the supply to the parish was uncertain in quality, and also very inadequate. The parish was one which was likely to become a health resort, and would probably grow considerably. At present it was supplied by three small Water Companies, none of which was a statutory undertaking. Their capital altogether amounted to a very small sum. It was admitted on all hands, even by the District Council, that some further supply was necessary at once. The Church Stretton Land Company had frequently been told that the need of a good water supply prevented people from purchasing land. No one but the Company was developing the district, except the Lord of the Manor, who would appear before the Committee in support of the Bill. The Land Company did not wish themselves to become suppliers of water; they were anxious, in fact, not to be so. Early last year, they approached the principal Water Company—the Church Stretton Company—and asked them whether or not they were prepared to make provision for an adequate supply. The answer was that the Company were unable to give it. The Land Company then wished to know whether the Church Stretton Company would be willing to unite with the Land Company in forming a new Company. But the answer was that the Water Company were unwilling to alter their present position. There was, therefore, a deadlock, and the only way out of the difficulty was for some of the Directors of the Land Company to take up the matter themselves, and promote the present Bill. The Committee would see that the Land Company were under obligation to promote it in order to protect their interests. The scheme intended to make provision for a future population up to 5000 persons; the present population being 1700. The scheme would provide for the whole area now supplied by the three Water Companies, and also the population which might settle on the present undeveloped land. Counsel then proceeded to show that the District Council were unable to provide an adequate supply of water, as was now proposed to be done. The promoters were prepared to buy out the existing Water Companies, which would prevent any injustice. They were prepared also to be laid under an obligation, after making the works and putting themselves into a position to supply water, to sell the works to the Local Authority, not at a high value, calculated on a 10 per cent. dividend, but on the ordinary terms—not as monopolists, but simply at a price which would ensure that the promoters would not be in a worse position financially than they were before. The Local Authority might have the option of purchasing directly the works were completed.

Mr. G. H. Dowell, the Chairman of the Church Stretton Land Company, then gave evidence in support of the Bill. Mr. E. Taylor, of Westminster, who had prepared the scheme before the Committee, explained the limits of supply under the present arrangement. He was followed by Mr. R. B. Benson, the Lord of the Manor, who said that, as a general rule, the present supply of water was sufficient in quantity for the houses in Church Stretton, but the number would doubtless materially increase. He understood the supply of water was insufficient last year. His opinion with respect to the provision of water by the District Council was that they had not enough money. The new Council would require to undertake sewerage works before water schemes. He supported the Bill.

On the following day, Mr. J. E. Profitt, the Secretary of the Church Stretton Water Company, gave evidence as to the working of the concern, which, in his opinion, was quite sufficient to provide for the wants of the people of the district. There was not a house in Church Stretton which the Company did not supply. If necessary, they could increase their works easily; but so far they had never found any necessity for doing so. The promoters of the Bill had offered to his Company to go into partnership in the new undertaking; and the Company had been willing to accept the offer conditionally on the promoters guaranteeing a satisfactory dividend. This they had never done. The inhabitants of Church Stretton were very much against the Bill.

Mr. Crossman absolutely denied the reception of any communication concerning the giving by the promoters of a guaranteed satisfactory dividend.

The next witness was Mr. W. Edwards, the Sanitary Inspector to the District Council. He said he looked after the water supply for Church Stretton. With respect to Little Stretton, he was satisfied with the supply, and had never heard a complaint; and respecting Church Stretton, the supply had always been sufficient till last year, when the works there were out of order for a few days. This had been the single occasion of faulty supply in an experience of twenty years. Mr. Harman, a member of the Parish Council of Church Stretton, said the water was the best in the country. There had never been complaints as to the quality or quantity of it.

Mr. Baggallay, in reply, dealt first with the financial position of the promoters, and then rehearsed all the points in the case. He said the promoters did not propose to acquire the present water-works compulsorily; but they were prepared to purchase if the existing Companies so desired.

The Committee decided that the powers sought should be granted, subject to the reduction of the proposed capital to £20,000, so as to bring the undertaking within the limits of the purchasing power of the Local Authority hereafter; the omission of a clause providing that the Company should not be compelled to supply certain baths and closets; the alteration from a charge of 8¾ per cent. on the rateable value for water supply to 7 per cent. as a maximum; the completion of the works within five years instead of seven; and the insertion of clauses giving the Local Authority the option of purchase when the works are completed.

The Price of Gas at Bolton.—The Gas Committee of the Bolton Corporation, at their meeting last Friday, decided to recommend the Town Council to reduce the price of gas from 2s. 6d. to 2s. 3d. net per 1000 cubic feet. It is stated that the Committee will be in a position to hand over in relief of rates £25,000 out of the profit earned during the past financial year.

Gas Affairs at Carlisle.—The Gas Committee reported to the Carlisle Town Council last Tuesday that they had agreed to make certain extensions of the trunk mains at a cost not exceeding £2075. Referring to the matter in moving the adoption of the Committee's minutes, Mr. G. Coulthard stated that it had been found that many of the pipes were not of sufficient size to meet the wants of the increasing population in the outskirts of the city, and an extension was therefore necessary. The last extensions took place in 1874 and 1883. The quantity of gas consumed had increased from 95 million cubic feet in 1874 to 150 millions in 1883, and to 260 millions last year. The same gentleman, in opening a series of cooking demonstrations by Miss Leng yesterday week, stated that there were now 1000 stoves in use in the city; and as there were 8000 consumers in the district, there was a good field for further business in this direction.

New Joint-Stock Companies.—A Company has been formed under the title of James Milne and Son, Limited, with a capital of £200,000, in £10 shares, to adopt an agreement with Messrs. James Milne and Son, Limited (in liquidation), and to carry on the business of engineers, &c. The Mickley Coal Company, Limited, has been registered with a capital of £162,000, in £100 shares, to acquire and take over the colliery known as the Mickley Colliery, now belonging to the partnership firm of the Mickley Coal Company, and generally to carry on business as manufacturers of coals into coke, patent fuel, and gas, workers of iron-stone and fire-clay, lead, brick, and tile makers, commission agents, and general merchants. The New Sunlight Incandescent Company, Limited, with a capital of £200,000, in £1 shares, are to acquire as a going concern the undertaking of the New Incandescent (Sunlight Patent) Gas Lighting Company, Limited, and carry on the businesses of manufacturers of, and dealers in, lamps, burners, gas-mantles, glasses, shades, and other gas and electric light fittings. With regard to the first-named Company (James Milne and Son, Limited), we may mention that the whole of the ordinary shares are taken by the vendor Company in part payment of the purchase price; and we learn that the 10,000 preference shares offered to the public have been applied for several times over. Letters of allotment and regret have been sent out.

Proposed Sale of the Holsworthy Gas-Works.—A meeting convened by the Parish Council was held at Holsworthy last Thursday, to consider an offer of the Gas Company to sell their works to the Council. Mr. R. Penwarden, the Chairman of the Parish Council, said the price asked was £1500, and the Council thought the undertaking ought to be acquired by the town, and not sold to a stranger. The offer was, however, only open until Saturday morning. The Parish Council had communicated with the Clerk to the County Council, and they were informed that, with the sanction of the Local Government Board, a loan could be obtained for the purchase of the undertaking. An expert had informed them that the works could be brought up to date for £300. Mr. M. T. Dickson suggested that, as the purchase would have to be conditional on the Local Government Board giving their sanction to it, a Limited Liability Company should be formed to close with the offer, and afterwards re-sell to the Parish Council. Other speakers concurred with the suggestion. A resolution was submitted to the effect that the Council should purchase the works; but though the attendance at the meeting is described as large and representative, only six voted for this proposition, while there was one against it. Mr. Penwarden remarked that the Parish Council would not feel justified in purchasing unless they had stronger support than this; and he suggested that the meeting should discuss the propriety of forming a Company to purchase the works. In the end, Mr. H. Higgs was appointed Hon. Secretary; and several of those present gave him their names as shareholders in the proposed Company.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Saturday, May 13.

(*Before Mr. Justice* STIRLING.)

Carr and Co., v. Bath Gaslight and Coke Company.

The proceedings in this case were reported in the "JOURNAL" last week. At the close of the arguments on the 6th inst. his Lordship reserved judgment, which he delivered to-day.

Justice STIRLING said the action was brought to restrain the defendants from polluting the River Avon by the introduction into it of a substance produced in the course of the manufacture of water gas, and also for damages. The defendants denied that they had wrongfully or in fact discharged any such polluting matter into the river. On this state of the pleadings, the action came on for trial. The plaintiffs, who were manufacturers of woollen cloth, were the owners of a mill situate on the Avon a short distance below Bath. The river was a very sluggish one, and one into which admittedly the whole sewage of the city was discharged; so that at no time was it a very pure stream. The difference between this and the other pollutions which existed in the river was mainly that the pollution complained of was heavy, while that which arose from sewage, being light, floated on the top of the water, and did not affect the plaintiffs' works, as the water was taken from near the bottom. The defendants, in October, 1895, commenced the manufacture of water gas, in the course of which petroleum was employed. After the gas was produced, there remained a residual liquid product, which also occurred in the manufacture of coal gas; and both products contained tar, as a main constituent. Water-gas tar and coal-gas tar differed in appearance, in specific gravity, and in smell; and it was the smell which, according to the evidence, could be relied upon as distinguishing the two. Both the tars were heavier than water. Down to June, 1898, the effluent was discharged straight into the river. On an average, 200 gallons of tar were produced daily; while 10,000 gallons of effluent were discharged. The plaintiffs said that in May, 1898, water-gas tar was found by them in the water used in their works to such an extent that it fouled the wool and cloth; and they had to stop their works for a time. They complained to the defendants; and on the 7th of June the latter discontinued for a time making water gas. On the 11th of June the writ was issued. On the 25th of August, the defendants resumed the manufacture of water gas, but with a variation. Instead of the whole of the effluent being discharged into the river, a little more than half of it was made to circulate in the works, so that it no longer went into the river. The smaller moiety was carried to the sulphate works on the other side; and, after being employed there, was ultimately discharged into the river, though in a dilute form. The plaintiffs alleged that, with regard to this second half, the deleterious ingredients in the effluent still remained. This state of things continued down to the 14th of March of the present year, when the defendants again altered their mode of dealing with the effluent, by making it circulate in such a way that no portion of it passed into the river. It was admitted by the plaintiffs and their witnesses that since that date the state of the river had been free from objection. The expert witnesses agreed that the mode in which the defendants now carried on their works was right and proper, though they thought the extent of storage for tar was too small. The amount provided was sufficient for four days' average and three days' maximum production. Dr. Armstrong was of opinion that there ought to be storage for ten days' average production. This seemed to be a question upon which experts might well differ; but it was not one upon which the Court was called upon to pronounce an opinion. The plaintiffs did not now ask for an injunction, but merely for an inquiry as to damages, with liberty to apply; and then there remained the important question of costs. This turned upon whether, at the time the proceedings were instituted, the plaintiffs had a good cause of action against the defendants. Two points had been raised on behalf of the latter—first, that the plaintiffs did not prove that they had suffered any damage attributable to water-gas tar; and, secondly, that they did not prove that the tar proceeded from the gas-works. As regards the first, the question was not merely whether damage had been proved, but whether there was in the river a polluting substance of which plaintiffs were entitled to complain so as to obtain an injunction; the question as to damage, strictly so called, being a minor point. From the evidence which had been given, it was clear that when the action was commenced there was oil-gas tar in the river, and that it came from the works of the defendants. If the plaintiffs desired an inquiry as to damages, they might take it at their own risk; but liberty to apply would not be reserved, as the cause of all the trouble had been removed. On the whole, he came to the conclusion that the defendants must pay the costs of the action.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Friday, May 12.

(*Before Mr. Justice* MATHEW *and a Special Jury.*)

Challice v. The Gaslight and Coke Company.—Liability for an Explosion.

This was an action to recover damages in respect of an explosion which occurred on the 20th of October last at Elm Grove, Cricklewood, through the alleged negligence of defendants' servants. The amount of damage having been agreed at £90, the only question left to the Jury was one of liability.

Mr. DICKENS, Q.C., and Mr. WOOD HILL appeared for the plaintiff; Mr. FOOTE, Q.C., and Mr. DANCKWERTS represented the defendants.

Mr. DICKENS said this was an action to recover damages in respect of an explosion caused, as alleged, through negligence on the part of the defendants' servants. The plaintiff's gas supply being deficient, he wrote to the Company; and on the 22nd of October two men named Lott and Dickenson came and "blew" the service-pipe. Some conversation took place between the servant and the men, which would be given in evidence. After the men left, there was a smell of gas all over the house. The servant did not do anything, being under the impression that after the gas-pipe was blown there was always a smell. At half-past four the servant lit the gas in the hall. Shortly after five she went into the dining-room, and noticed that under the chandelier the carpet was wet; and the suggestion on the plaintiff's part was that the water had been forced out by the blowing operation. As the servant was going upstairs, there was a violent explosion, with the result that the door and windows were blown out, and a great deal of damage was caused. On the 5th of November, a claim was made in respect of the damage; and as the defendants denied all liability, the present action had been brought.

The following evidence was given:—

Edith Johnson said that at the time of the explosion she was the plaintiff's servant. On the 22nd of October, two men in the employ of the Gas Company called about half-past two, and said they had come to see to the gas. After obtaining the key of the meter, they turned the gas off, and then blew the inlet-pipe. After this they lit the gas in the kitchen. Then they asked witness to light the gas upstairs; and one man inquired if it was all right. Mrs. Challice said the gas was all right except on the landing; and Lott went upstairs to see to it. Having removed the burner, he said it was not the fault of the gas but of the burner. Dickenson called out to Lott that the meter was ticking. Witness asked the man whether there was anything wrong. He replied: "It is too near the water to be an escape. It ticks like a clock." He asked her to come and listen to it. They both stood in the scullery listening to the meter. At this time every burner was turned off. Lott came downstairs and said everything was all right. The men remained about half-an-hour. After they left witness still heard the meter ticking. The gas was lit in the hall at half-past four. The dining-room door was closed after the men left. When witness took the tea up to the dining-room, there was a smell of gas all over the house. Shortly afterwards the explosion occurred. Underneath the chandelier there was water on the carpet.

Cross-examined: The gas in the dining-room was not lit before the explosion. There was a small fire in the room, and light enough to enable her to notice the water on the floor. She knew it ought not to be there, but thought perhaps water had been spilt at dinner time. She never pulled the chandelier down to light the gas. She did not tell the police-constable who came that when she went in to lay the table she lit the gas. The constable asked whether the dining-room gas was alight, and witness replied that it was not. She had lit the taper by the gas in the hall in order to light the gas upstairs when the explosion took place. The gas in the dining-room was not burning all the time they were listening to the ticking of the meter. One of the men said there was nothing wrong in the ticking. When he said it was "too near the water," witness thought he meant the gas was too near.

Re-examined: Before the men came, she had never noticed an escape. Between the time of the men leaving and the hall gas being lit, there was no gas burning in the house. She did not pull down the chandelier and light the gas.

Mr. *R. D. Challice* said that on Oct. 6, as certain alterations were being made in the dining-room, the chandelier was taken down and afterwards re-fitted. Between that date and the time of the explosion there was no escape of gas. The room was used every day. On Oct. 19, he wrote to the Gas Company complaining of insufficient supply. He was not at home on the day of the explosion. The day after he called and saw the Manager, who asked the Inspector for his report, and after reading it said there was no doubt the escape was caused from want of water in the chandelier—that there being only a small quantity of water after the pipe was cleared, the extra pressure of gas would force the remaining water out. As witness could not contest this explanation, he had to accept it; it having escaped his memory for the moment that he had had the chandelier seen to only a fortnight previously. His servant having informed him that she called the attention of the men to a strong smell of gas in the house, and also to the ticking of the meter, the men were told of this; but they denied that anything of the sort took place. Witness asked them whether they thought the servant, who had nothing to gain by it, would tell a deliberate lie. On Dec. 3, witness again had to complain of insufficient supply; and upon the 18th of the month the meter was taken away. It was absolutely untrue that he requested that the meter should be taken away on account of its being noisy. Lott asked whether he would like the meter changed. He had not been informed by anyone that the burners were found alight after the explosion. He had no theory as to how the accident happened.

Mrs. *Challice*, the wife of the last witness, said that between the time of the alteration and the Company's men calling there had been no smell of gas in the house. She was out at the time of the explosion.

Bruce Twine, a gas-fitter in the employ of Messrs. Carpenter, of Cricklewood, proved that on the 6th of October he took down the chandelier in the dining-room, and, having re-fixed it, he put in water and tested it. He was certain that when he left there was no escape of gas.

Cross-examined: He filled the outer tube to the top. The evaporation of the water would depend upon the heat of the room.

Thomas Calverley, a gas-fitter, said he went to the plaintiff's house shortly after the explosion, and found the stem of the chandelier hanging from the ceiling, and the body in the garden. The body was almost gas-tight. The ticking of the meter, if all the burners were off, would indicate a leakage. The Company had no right to touch the outlet-pipe.

Mr. FOOTE said he quite agreed. This case was that they never blew through pipes on the outlet side.

Witness, in cross-examination, said the ticking merely showed that gas was passing through the meter.

This was the case on behalf of the plaintiff.

Mr. FOOTE, in opening the case for the defendants, said he should prove that nothing was done by the Company's men to the pipes on the house side of the meter. Under these circumstances, the plaintiff had to show that the Company were guilty of some negligence which caused the explosion. It was not enough to say that the Company's men were there all the day; that there was an explosion the same day; and that therefore the men must have caused it. It was common ground that the men had had all the gas in the house lit and turned off again; that they left about ten minutes to three; and that the explosion occurred about five o'clock. There were only two possible causes which could have brought about an explosion—namely, the gas must have escaped either from the burners or from the top of the chandelier where

the water was put in. It would be important to know whether the gas in the dining-room was lit after the men left, and in what condition the chandelier was found after the explosion. With this object, he should call two men who went into the room immediately after the explosion, and who would say that they found the gas burning at each burner and at the top. Of course, it was impossible that the explosion could have turned on the burners. It was inconceivable that Lott and Dickenson, who were engaged in this kind of work every day of their lives, would, after listening to the ticking of a meter, go away saying it was all right, if they knew that every burner was turned off. After hearing the evidence for the defendants, he was sure the Jury would have little difficulty in coming to the conclusion that the explosion was not due to any negligence on the part of the defendants' servants.

Thomas Lott said he had been a gas-fitter in the employ of the defendants for five or six years. He had not served any apprenticeship. He had been engaged in blowing naphthalene out of the pipes for about four years. When he went to a house to do this, his custom was to ask whether there was any gas alight in the place. On being assured that there was not, he disconnected the service-pipe from the meter, and then tried the pressure. If it was insufficient, he charged the pump, put the nozzle on to the service-pipe, and blew into the main. After clearing the pipe, he tried the pressure again to see that there was a good supply coming through. Upon connecting the pipe, he should tell his mate to try the gas in the house, to see that the gas was going through. He then turned out all the lights but one, to test the meter. Afterwards this light was turned off, to test the meter again, in order to see that there was no escape. All meters made a noise by ticking when gas was passing. He never interfered with the outlet-pipe. This plan was strictly followed when he went to the plantiff's house on Oct. 22.

Cross-examined: The servant did not tell him that the meter was ticking—his mate did; but he could not say why he told him so, if everything was right. The servant did not say, when she heard the meter ticking, "Is there anything wrong?" Neither did witness say it was "too near the water." The story told by the servant was absolutely untrue. Witness afterwards reported that the meter required changing, "by request of the consumer, on account of its being noisy." At this time he had been told by Mr. Challice what the servant had said; but he did not think there was any need to say that there had been no such conversation as that which was deposed to. Asked why, when it was suggested that he had been negligent, that the meter was ticking, and that there was no gas on, he did not say, "Oh, the gas was off; I watched it for five minutes, and there was no ticking," witness replied that he did not think there was any occasion to do so. In further cross-examination, he said he did not blow the outlet-pipe, as the effect of doing so would have been to force the water out of the chandelier. The explosion could have occurred from there being not enough water in the chandelier; but if it had been filled twelve days before, the extra pressure would not have blown the water out. He did not look to see whether there was sufficient water in it.

Re-examined: After the pipe had been blown, the pressure was only what might be described as ordinary pressure for a house. The Gas Company's men never blew the outlet-pipes.

Jacob Dickenson, assistant gas-fitter, said he went with the last witness to Elm Grove; and after the pipe had been cleared he lit the burner in the kitchen and the three burners in the dining-room. His mate went upstairs, and afterwards told him to turn the lights off in the dining-room, which he did. There was a big fire in the dining-room. It was not his duty to see whether there was water in the chandelier. The meter was afterwards tested with the one light in the kitchen. After all the lights were turned off, his mate looked at the dial for five or six minutes, to see if the meter was working. Witness did not hear any ticking. The servant spoke about the ticking while his mate was upstairs. Witness called out that the meter was making a noise; and his mate said "all right."

In cross-examination, witness said that the fact of the meter ticking did not make him think there was anything wrong, because one burner was alight at the time. The servant did not ask him whether there was anything wrong; nor did he ask her to come down and listen to the meter. He did go with the girl up to the meter and listen; but this was to make sure that the meter was ticking. He did not know why he did this.

G. A. Warner, a gas-fitter, who was working a short distance off, said he heard the explosion, and immediately went to the house, where he found the dining-room wrecked. All three burners of the chandelier were alight; and there were flames from the top. Witness turned the meter off, and capped the service. There was a fire in the grate.

Harry Waters, a lamplighter, said he went into the room after the explosion, and found fire at the top of the chandelier, and the burners alight.

Police-Constable *Vass*, who went to the house after the explosion, said the servant told him she had laid the tea in the dining-room, lit the gas, and had just come out of the room when the explosion occurred.

Edward Morgan, foreman gas-fitter in the Company's employ, said he examined the chandelier, and found the cup melted off from the stem.

Mr. *T. V. Fenn*, Divisional Chief Inspector of the Gas Company, said when plaintiff called he asserted that the accident had been caused through the carelessness of the Company's men. He said the meter was ticking when all the lights were off, so that the burners must have been left on in the dining-room. Witness replied that this would be impossible, as Lott had tried the meter for the purpose of ascertaining if it would register a small light; and after satisfying himself that it would do so, he had the light turned off and watched the meter for five or six minutes, and failed to detect the slightest passage of gas. Had there been the smallest escape, the test guard would at once have shown it. The cup being melted off, clearly proved that the gas must have been alight at that point. Chandeliers of this description were dangerous, and were not now being used.

In cross-examination, witness said there might have been enough water in the chandelier before the pipe was blown; and there was a possibility that the extra pressure was sufficient to cause the gas to escape. His theory was that the gas escaped in consequence of the servant pulling the chandelier down too far. It was the consumer's duty to see that the chandelier was properly charged; and it was the man's duty before leaving to make certain that there was no escape at that time. The Company would pay no more attention to a dangerous chandelier than to any other. It was for the consumer to keep it properly charged with water. This should be done about once a month.

Mr. *S. A. Pardoe*, a gas engineer, said he had examined the chandelier in question, and found the cup disconnected from the outer tube. This showed that fire must have occurred at that point. Unless the gas had been escaping at the cup, the solder could not have been melted. It must have been a continued heat, not a momentary one. The three burners could not have been turned on by the explosion. If they had been left on by the men, and there was a fire in the room, the explosion would have occurred about an hour after they left.

Cross-examined: Of course, this would depend upon the amount of gas escaping.

Mr. *G. F. L. Foulger*, Chief Distributing Engineer to the Company, said that 7 per cent. of gas mixed with air was the least quantity which would form an explosive mixture. The greatest explosive force was attained with 10 per cent. of gas. With 15 per cent. of gas, the explosion would be very slight; and with 16 per cent. there would be no explosion at all, but merely a flame. Had the gas been left on by the men, with a fire in the room, the explosion would certainly have occurred in from three-quarters-of-an-hour to an hour afterwards. The Company were bound to keep the fittings up to the meter in repair. They had nothing to do with the fittings on the other side, and had no right to meddle with them.

This concluded the evidence; and Counsel having addressed the Jury,

His Lordship said the simple question was whether or not the defendants' servants were guilty of negligence. It was clearly their duty to ascertain before leaving whether there was an escape; but this duty it was said had been discharged—the men having taken every precaution to see that there was no escape. After referring to the evidence, he left it to the Jury to say whether the Company's men had discharged their duty, and taken proper care to ascertain whether there was an escape of gas.

The Jury, without retiring, found for the plaintiff.

His Lordship entered judgment for the agreed sum of £90, and certified for a Special Jury.

SHOREDITCH COUNTY COURT.—Tuesday, May 9.

(*Before His Honour Judge* D. O'C. French, Q.C.)

A Gas Explosion and a Service Layer's Compensation.

This was an action brought by David Willis, a gas service layer, against The Gaslight and Coke Company for compensation for injuries sustained by him through a gas explosion while performing his duties.

Mr. J. P. Budden appeared for the plaintiff; Mr. H. W. Loehnis (instructed by Messrs. Bedford, Monier-Williams, and Robinson) for the Company.

Mr. Budden having explained that the case had been brought under the Employers' Liability Act, stated that the plaintiff at the time of the accident was engaged in connecting a service-pipe to premises in Printing House Yard, Hackney Road, under the direction of a foreman. This foreman instructed him to go into the building, and hold a certain pipe. There was already a gas service-pipe running into the place.

His Honour (interposing) asked why the action had not been brought under the Workmen's Compensation Act?

Mr. Loehnis: The Workmen's Compensation Act does not apply. These are labourers who do work not on the Gas Company's premises, but on other premises.

Mr. Budden (continuing) said the negligence complained of was that the foreman, before he gave the order to hold the pipe while he was connecting the second service, did not take proper precautions to see that the first service was turned off. The result was that there was an inrush of gas from the service which was being connected, an explosion took place, and the plaintiff was badly burnt. He was taken to a hospital, where he remained two or three weeks, suffering from considerable injury.

David Willis, the plaintiff, stated that the accident occurred on Nov. 22 last. The premises at which they were working was a plate-glass factory; and the second service-pipe which they were putting in was for the supply of a gas-engine. The foreman told him to step inside, and hold a pipe underneath a staircase. As soon as they began to connect up, the gas rushed into the building from the main, and, coming in contact with a naked light, caused a loud explosion, which blew him "halfway out of the place," and set him and the building on fire. He was extensively burned on both sides of the face and arms; and it was about six weeks before he could go to work again. His wages were 24s. a week.

Cross-examined: He was working with a man named Barratt; and there was another man called Hawkins in the gang. The foreman's name was Gout. Barratt gave him what they called a "short piece" to screw on inside the house before the connection was made outside. But he did not give him any tools to do it with, and he had to screw it on with his hands. [Counsel, by means of an elbow and short straight piece of piping, the same as was being used at the time of the accident, showed that this could readily be done.] Asked whether, when Barratt got outside, he did not inquire whether "it was all right," plaintiff admitted that he did, and that his reply was that he had screwed the piece on.

Mr. Loehnis: You had not screwed it on, as after the occurrence it was found on the floor. You and Barratt are merely fellow-labourers.

By His Honour: It was through Barratt's neglect that the gas escaped. He had charge of the job. The gas came through the hole they had made in the brick work. Barratt should have seen, before he connected up, that the pipes were all screwed together, and that there were no naked lights near. The naked light was 4 or 5 feet away.

George Edy, foreman at the plate-glass factory, said he remembered on the date in question the Company's working foreman coming into their premises, and asking whether it would be inconvenient to have the light extinguished while the service-pipe was being connected. It was arranged that the light should be turned out between 1 and 2 o'clock. It was lit again about 2.30; and the explosion occurred at 3.40. After the explosion, the working foreman said he would be called "on the carpet," and discharged from his employment, through his negligence in having a light there.

Mr. Loehnis submitted that the case did not come under the Employers' Liability Act at all.

His Honour pointed out that a foreman engaged in making any gas

connection ought not to have a light so near. He thought this showed negligence.

Mr. LOEHNIS observed that Gout was the foreman; and he was not on the premises at the time of the accident. It was not by his orders the connection was made with a flame burning near; and he took every precaution he could.

His HONOUR said he could not agree with Counsel. Gout ought to have suspended work if he could not have a clear field.

Mr. LOEHNIS: This is a serious matter for the Company——

His HONOUR: There is no principle involved; it is simply a question of fact.

George Gout was then called. He said he was the service layer foreman to the Company. Barratt, Willis, and Hawkins were labourers, all occupying the same position. On the day in question, he visited this job about 12 o'clock; and he did not notice the gas-bracket in the basement. The men engaged there were all accustomed to laying services. After the accident, he saw Willis, and asked him whether Barratt did not inquire whether it was all right before making the connection, and he replied that he did.

Cross-examined: He did not take steps to have the light put out when the connection was being made, because he was not there. Willis was as capable of doing the work as he was himself.

Daniel Barratt stated that he had been a service layer for some time, and was when the accident occurred receiving the same wages as Willis. He was not the person who had the conversation with Edy about putting out the light.

Edy was recalled; but he could not recognize in Gout, Barratt, or Hawkins the man with whom he had the conversation.

Mr. LOEHNIS: Then that conversation did not take place with anyone representing the Gas Company.

His HONOUR: If it did not, it ought to have done. In making these connections, someone in authority ought to see that the men are working under safe conditions.

Mr. LOEHNIS said the question was whether there was any necessity for it. The only way in which gas could get into the house would be through the service-pipe; and if the short piece had been properly screwed up, there would have been no escape.

Witness (continuing) said that, after he had given Willis the short piece, he went outside to make the connection. Before doing so, he asked Willis if it was all right; and he replied that it was, which meant that he had screwed on the short piece. The main to which they were connecting was 12 feet from the inside of the building. After the explosion, he found the short piece lying on the floor. The explosion could not have occurred if it had been screwed on properly.

Mr. LOEHNIS submitted that the case did not come within the Act at all. There must be negligence of a person with superintendence entrusted to him while in the exercise of that superintendence. He failed to see that any case had been made out. He recited the facts as brought out in evidence, and charged Willis with contributory negligence. Plaintiff did not screw on the short piece properly; and he knew as well as Barratt (who was only a fellow-workman) that there was a gas-jet burning near. It was suggested that there was negligence on the part of Gout in not seeing that the gas was turned out. But there was no necessity for that, if the work had been done properly. Gout's business was to go about, and see that the men were doing their work. The men themselves were all competent, and accustomed to laying services.

His HONOUR, in giving his decision, said a foreman entrusted with the superintendence of work of this kind held a serious and responsible position. The conversation with the foreman of the glass-works satisfied him that the Gas Company's people knew and guarded against the effect of lights on premises where work was going on. The foreman ought to have secured a longer time in which to have done the work. In this case no question of law or principle arose. The fact that the foreman had seven or eight other jobs in hand showed that he could not give proper attention to this one; and, gas being used there, the work should have received very careful attention. He found for the plaintiff for the amount claimed (£10), with costs.

Liability for Damaging Lamp-Posts.

At the Huddersfield Borough Police Court, on Monday last week, Edward Breear, teamer, of Keighley, was summoned for "accidentally damaging a lamp-post to the amount of £3 0s. 9d.," on Feb. 16 last. Mr. W. Hudson, Deputy Town Clerk, appeared for the Corporation, who instituted the proceedings, and stated that the summons was taken out under section 20 of the Gas-Works Clauses Act, 1847, which enacted that any person who "carelessly or accidentally" threw down or broke a lamp-post, should pay in respect of the same a sum which two Justices thought reasonable. Jonathan Roebuck, engine tenter at the gas-works, said he saw defendant driving down Albert Street, Lockwood, on the date named. The wheels on one side of his lorry were on the kerbstone, and the vehicle struck a lamp-post and knocked it down. Witness had to shout several times to the defendant before he could get him to stop; and he asked him why he was running away without stopping to see whether or not there was an escape of gas. Defendant replied that he was not running away. He gave witness his name, and suggested that he should look on the lorry for the name of the owner. Defendant told the Magistrates that his horse shied. Witness denied this, and his denial was supported by a girl who saw the accident. Thomas Stansfield, lamp superintendent, proved that the charge for damages was reasonable. Defendant said he was only a poor man, and he hoped the Bench would be lenient. He repeated that the horse shied, and before he could get it off the causeway the lorry knocked down the lamp. The Magistrates' Clerk (Mr. Mills) remarked that if the horse shied it was a question whether or not he was liable. Mr. Hudson submitted that if the horse shied the defendant "accidentally" broke the lamp. Mr. Mills said he did not think so. He took it that if something occurred through defendant's carelessness, and it might have been prevented, he was liable for it; but if an accident occurred which he could not avoid, he did not see how defendant could be held responsible. Mr. Hudson remarked that, as the defendant admitted that he knocked the lamp down, it was for him to prove that he was not to blame. The witness Roebuck was recalled, and in answer to a question by the Chairman (Sir Joseph Crosland) as to whether he could suggest how the lorry came to be on the footpath, said the defendant was asleep at the time. The defendant denied this. The Magistrates ordered defendant to pay the damage and costs—a total of £3 15s. 9d. Another case of a similar kind was disposed of by the Bench. A man named Watson was proceeded against for damaging a post to the amount of £2 2s. 4d. The wife of the defendant appeared, and said her husband was unable to attend; having obtained a new situation to go to that morning. He acknowledged having broken the lamp. He had had to deliver some coals, and while he had left the horse for a few moments to attend to the customer the animal became restive, and ran with the waggon against the lamp. As soon as the accident occurred, her husband did the best he could. He stopped the gas from leaking, and went and told a policeman what had happened. He also told his master about it. Mr. Hudson said both the defendant and his employer had been written to, and they had refused to pay the damage. A police-constable confirmed the fact that the defendant told him of the accident. The Magistrates ordered defendant to pay the damage, and 13s. expenses.

The Charge against a Sheffield Accountant.

At the Yorkshire Spring Assizes at Leeds, last Thursday, before Mr. Justice Bucknill, Robert Kershaw, 54, described as an accountant, of Sheffield, was placed upon his trial for feloniously shooting at his daughter, Miss Agnes Kershaw, with intent to murder her, on the 12th of March. The accused had been Chief Accountant to the Sheffield Gas Company; and the circumstances under which the crime with which he was charged was committed were set forth at the hearing before the Magistrate (see *ante*, pp. 746, 873). Mr. Valentine Ball made a strong appeal on behalf of the prisoner; urging that the hallucination which led to his committing the outrage was the result of long-continued drunkenness. He submitted that the expressions used by Kershaw were evidence of a disordered mind. Prisoner addressed the Court, and promised, if leniency were shown him, to do everything he could to make reparation, and never to take drink again. The Jury returned a verdict of "Guilty;" and his Lordship sentenced the accused to penal servitude for seven years.

The Assessment of Premises for Water-Rate.

Last Thursday, Mr. A. Gorham, of 31, Lynton Road, Brondesbury Road, Kilburn, was summoned before the Harlesden Magistrates for having disputed the correctness of the annual value put upon his house by the West Middlesex Water Company for the purpose of fixing the amount of the water-rate. The proceedings were taken under section 68 of the Water-Works Clauses Act and section 142 of the Railway Clauses Consolidation Act, in order that the Bench might ascertain the amount of water-rate. Mr. Gillett appeared for the Company; Mr. E. M. Smith represented Mr. Gorham. The case arose out of an action in the Bloomsbury County Court, where the Company sued for a quarter's rate based on the annual value of £31. On behalf of the defendant, it was successfully contended that the local Magistrates must fix the annual value of the house. Mr. Gillett said the Metropolis Valuation Act did not apply here, as the road was not in the Metropolis; but the Company treated it as if it were. Where the annual value exceeded £30, the Company had power to charge extra for high pressure, bath, &c.; and the question here was what was the rateable value of this house. The rental was £38 per annum, and the maximum reduction under the Act he had mentioned was one-fifth, which would be £7 12s., leaving the annual value for rating purposes at £30 8s., a sum exceeding £30. In the usual course, the house was assessed at £31. Mr. Ranklin, the Company's Surveyor, said in his opinion the house should let at £40 a year. Mr. Leopold Farmer thought it might let at this amount. It was usual to deduct one-fifth from the rental. In this instance, £5 7s. 6d. deducted would cover the cost to the landlord, and would leave £32, if the odd shillings were ignored. Mr. Wybroo, the Secretary to the Company, produced the rate-book and supported the opening statement. In cross-examination, he denied that the extra sovereign was put on just to give the power to charge for the high pressure. Mr. Smith said the extra sovereign made a difference of 14s. a year to a tenant; and he called evidence to the effect that the house was not likely to let again for so much as £38, from which sum the following landlord's expenses should be deducted: Insurance, 8s.; collection, 35s.; Queen's taxes, £1 1s. 10d.; and repairs, £6 10s. The landlord reckoned that he got £28 net. The Bench decided that the annual value was £31. Mr. Gillett, in asking for costs, said the defendant was the champion of a number of consumers; and this was a test case. Costs to the amount of £5 were allowed.

Burslem Gas Supply.—At the meeting of the Burslem Town Council yesterday week, Mr. Leigh, in moving the adoption of the report of the Gas Committee, stated that the expenditure on the gas-works last year was £24,179, compared with £22,140 in the previous twelve months. The receipts were £24,232; leaving a balance in hand of £53. Last year the Committee handed over £1000 to the Council in relief of the rates; but he wished to point out that this year the Committee had not charged for street lighting, as had been formerly done. This meant a reduction of £1919 in their receipts. Therefore virtually the Gas Committee were giving to the town £919 more than last year. But even these figures did not represent the full profits. Certain improvements and extensions had been paid for out of revenue. The Committee laid out £1028 to purchase land for which they might very well have borrowed money; £862 was also spent upon stoves. Altogether there was practically a profit of £4147. Referring to extensions of the manufacturing and storage plant which it was proposed to carry out, Mr. Leigh said the introduction of the new retort-houses which they proposed to obtain would materially reduce the cost of carbonizing the coal. The Manager (Mr. J. Tindall) thought the saving would be nearly sufficient to meet the repayment of principal and the interest. By the introduction of the proposed new gasholder and tank, they would be trebling the accommodation at the works, and, at the probable rate of increase of their output, the accommodation they proposed to provide would last for fifteen or twenty years. The report was adopted.

MISCELLANEOUS NEWS.

A BLAZING HOLDER AT THE ST. HELENS GAS-WORKS.

An explosion almost unparalleled in character by anything which has happened in this country caused consternation among the inhabitants of St. Helens last Friday morning. The town is the centre of a great colliery district which contains large chemical and glass works; and one of the former—known locally as Kurtz's Chemical Works, belonging to the United Alkali Company, Limited—was the scene of the catastrophe. Shortly after ten o'clock, a slight fire broke out in the chlorate of potash refinery. The men were ordered to get away as soon as possible, and the Fire Brigade were communicated with by telephone; but before they arrived a violent explosion took place, blowing up the building, and sending forth a great column of smoke. The shock was felt all over the town; and scarcely had the inhabitants recovered from it than there was a second explosion which reduced the works to ruins. The buildings in St. Helens were shaken to their foundations and more or less damaged—nearly every pane of glass being shattered. The concussion was felt at Prescot and Haydock, some five miles distant; and it was heard at Walkden and Little Hulton, eighteen miles off. Unhappily, five men were killed; and about fifty people were more or less injured. One of these was a plucky lad of 16, named Charles William Wilson. Attracted by the report of the fire, he climbed a ladder to the top of the gasholder nearest to the works, and when the gas ignited he was set on fire; but, preserving his presence of mind, he slid down the ladder, and immersed himself in the water in the gasholder tank. On Saturday he was lying in a critical condition. The force of the explosion took mainly a westerly direction; and the Hardshaw Brook works, also belonging to the United Alkali Company, stood right in its path. Here tremendous havoc was wrought—almost as much damage being done as in the Kurtz works. A dozen huge vitriol chambers, each about 110 feet long, 20 feet broad, and 30 feet deep, containing an enormous quantity of sulphuric acid, were levelled to the ground. The thick lead sheeting with which they were lined, together with the timbers forming part of the structures, was hurled into an adjoining highway and twisted into fantastic shapes. Adjacent to the Hardshaw Brook works are the gas-works; and the question our readers would naturally ask is: How did they fare in the midst of all this devastation? Fortunately, as a whole, they had an extraordinary escape. One gasholder, however, containing about 250,000 cubic feet of gas, had some of its crown plates punctured by falling *débris;* and the escaping gas becoming ignited by burning material from the neighbouring chemical works, a tremendous flame shot up. Fears were entertained for the safety of the adjoining holder, on which burning splinters had fallen. But some of the men, with true English pluck, bravely climbed to the top and removed them. The following account of the occurrence was given to a representative of the "Liverpool Courier" by the Corporation Gas Engineer, Mr. S. Glover: His attention was first called to the danger by the "buzzer" from the Kurtz works. Coming out of the office, he looked over towards the works, and saw dense volumes of smoke accompanied by pungent fumes arising from the Hardshaw Brook Chemical Works. Knowing the danger, they took what steps were possible to avert damage to themselves. In a few moments there was a terrific explosion. It shook the whole works and damaged all the buildings. The most serious injury, however, was to one of the two gasholders—the one nearest to the works where the explosion took place. Flying fragments of burning wood were hurled on to the top of this holder, and one or two puncture-holes caused. The gas escaped from these rents, and took fire. The top of the holder was torn right across, and the flaming gas leaped up in a vivid flame 300 or 400 feet in height; but there was no explosion, and the vessel gradually sank down into its tank, where it now remains a complete wreck. It was about three-quarters full at the time, and contained a quarter-of-a-million cubic feet of gas. The men employed in the works behaved with commendable bravery and coolness. Undeterred by the fate of the wrecked holder, they climbed to the top of the other, and threw down the burning logs of wood which had been blown there by the explosion. Some of these pieces were two or three yards long, and very heavy. The governor-house and a cottage in which one of the men lived were totally wrecked inside, and all the articles of furniture smashed. One door was blown completely away. The gas supplied to the town was shut off at the time of the explosion; but as the works have another gasholder at Knowsley Road, in addition to the one which was saved, the supply to the town will not be interfered with. Mr. Glover added that he had always held the opinion that no explosion would occur on an occasion like the present, if the gasholder sank into its tank. There were more dangerous places in the works than the holders; but fortunately no damage was done to the apparatus in the purifying-house, otherwise the result would have been extremely serious.

THE MANAGEMENT OF THE LONGTON GAS-WORKS.

The Report of the Investigation Committee.

In the paragraph on the subject of the management of the Longton Gas Works which appeared in the "JOURNAL" last week (p. 1237) reference was made to the report of the Special Committee appointed to investigate the matter. We have since received a copy of the report, and give below the principal portions.

The Committee began by stating that, inasmuch as the present condition of affairs has arisen to a considerable extent through the mismanagement of the new retorts, they feel bound to go somewhat fuller into details than otherwise would have been necessary, and to advert to the report made by Mr. T. Newbigging, who examined the works in 1896. Mr. Newbigging recommended, among other things, that a new retort-house should be erected, to contain six through ovens, and that regenerative firing should be adopted. In order to apply this system, it was necessary that an underground passage round the retort-house should be formed, the floor of which should be some 8 feet below the charging-floor. In attempting to carry out this recommendation, it was found that the ground was so water-logged that the firing-chamber could not be built below the ground-level; and, in consequence, the retort-house floor had to be raised above the rail-level in each case. It therefore became necessary to provide machinery to lift the coal out of the railway trucks. On fully considering these circumstances, the Committee were of opinion that the provision of lifting machinery, in conjunction with self-emptying waggons, would more than repay their cost. The adoption of this system naturally lent itself to the mechanical firing of the retorts, the further cost of which was only a small matter. After a thorough investigation, Winstanley's retort-settings and West's stoking machinery were adopted. The plans were prepared under the supervision of the Manager, and unanimously approved by the Committee; and the work has been carried out in accordance therewith.

The new retorts were set to work at the beginning of October last, under the supervision of an agent for each of the contractors.* The men at the works, however, did not take kindly to the new machinery; and differences soon arose. The Manager (Mr. W. S. M'Gregor) was warned that the foreman was adverse to mechanical firing, and was doing all he could to prevent its success. The Manager's explanation of his reasons for not calling the Committee together and laying this information before them is that the Chairman was very ill at the time, and he shrank from telling him anything that might cause him worry and anxiety; besides which, taking into consideration the fact that the foreman was such an old servant of the Corporation, he thought it was only a little personal feeling between him and the strangers. Unfortunately for the Corporation, this hope does not appear to have been realized; and after the Contractors' agents had left, the foreman failed to carry out the orders of the Manager, and, it is stated, altered the dampers and other parts of the plant, after the Manager had fixed them, and given positive orders as to how they should be worked, by which means damage was done to the retorts and benches. At the same time the retort-lids were injured owing to the men closing them without removing any tar which might be in the hinge; and when, as a consequence, the screw fastening the lid did not act, they battered it with blows of their shovels or anything that happened to be handy. The Manager states that he called the foreman's attention to this, and ordered him to see that the work was properly carried out. But this he did not do, and rather encouraged the men in their feeling against the new works. This naturally increased the Manager's difficulties. During this time inferior gas was supplied to the town. Mr. M'Gregor explains that his reasons for not calling his Committee together and reporting these circumstances at the time is that these occurrences took place between the 1st and the 9th of November, when the Committees of the Corporation were not in existence, and immediately after the latter date the Chairman died. On the 17th of November, the Committee were called together and made acquainted with all these facts. The Manager then stated that he had been working night and day; but, notwithstanding this, he was afraid the town would be in darkness on that or at any rate on the following night. The Committee at once telegraphed to Mr. West to send a competent man to take charge of the retorts; and, meanwhile, by great exertions, the town was kept supplied with gas. On the following Monday, Mr. West attended before the Committee, and made a full report on the result of his examination of the works. It was to the effect that the new retorts had been undoubtedly much injured, but to what extent he could hardly say; and that, so far as he could ascertain, this had been caused by the conduct of the foreman. Thereupon the Committee suspended the foreman for fourteen days, and, after making further inquiries into the matter, ultimately dismissed him.

Seeing that this happened during the period in which the largest consumption of gas takes place, the Committee considered that the only course open to them was to defer repairing the damage to the retorts until the summer months, when the demand for gas would be less, as in their crippled state it would be all they could do to keep the town supplied, even with the additional help of such of the old retorts as could be temporarily used. Unfortunately, relying on the new retorts, the old ones had not been repaired in the summer; the Committee not feeling justified in doing so in face of Mr. Newbigging's report that they were dilapidated and generally defective, and not worth any outlay upon them for repairs. The Committee thereupon gave instructions for the new and old retorts (although both crippled) to be kept going; being quite aware that they could not expect good financial results under these adverse conditions. Notwithstanding this, however, from the Manager's monthly reports, the results did not appear to be so unfavourable as now turns out to be the case. Unhappily, these monthly returns have been misleading; and on going through the books for the purpose of preparing the estimates for the laying of the rate, it was ascertained that there would be no profit to hand over to the Corporation on account of the gas undertaking for the past year.

The whole of the circumstances in connection with the matter were verbally reported to the Council by the Chairman at the monthly meeting on the 6th of April; and at a special meeting of the Committee, held on the 11th, the question of the general management of the works was considered. The clerks in the office were called before the Committee and questioned as to their duties, &c.; and the Committee examined the books and the method of keeping them. The investigation as to the monthly returns pointed to an unfortunate carelessness on the part of the Manager in accepting figures from the clerks without checking them, and, in fact, to a great want of appreciation on his part of the seriousness and importance of those returns, although, of course, he was responsible for them. This system has since been altered, and the Manager now always checks each item of the reports before they are laid before the Committee.

The Committee say it ought, in justice to the Manager, to be pointed out that, although misleading the Committee and the Council from month to month, the figures contained in the reports do not form part of the accounts of the department, and could in no way affect the ultimate result of the year's working. No decision was arrived at at the meeting referred to, which was adjourned to the following day, when the Manager tendered his resignation, which was accepted. It was thereupon decided to divide the secretarial work from the manager's, and to advertise for a manager as well as a secretary and cashier; these appointments, and the re-arrangement of the office staff, to be left in the hands of the Gas Committee.

* See "JOURNAL," Vol. LXXII., p. 919.

BIRMINGHAM CORPORATION GAS DEPARTMENT.

The Annual Report.

The annual report and accounts of the Birmingham Corporation Gas Committee, which will be submitted at to-day's meeting of the City Council, show that during the year ending March 31, 514,733 tons of coal were carbonized at the various works, and 5,201,607,000 cubic feet of gas produced. The gas-rentals, averaging 2s. 1d. per 1000 cubic feet, realized £543,850, the sale of coke and breeze brought in £52,841, tar £25,757, and ammoniacal liquor £36,348. This gives a gross earning of £658,996. The department contributed £16,443 towards the cost of public lighting; and after deducting the expenditure, the net profit available for the reduction of the city rates was £30,320. This amount was paid to the relief of the improvement rate for 1899. All the items of revenue, except the sales of tar, show a substantial increase; but, on the other hand, the expenditure has been heavier, so that the net profit is reduced. In 1897-8 it was £50,336. The total revenue of the department was £666,425, as against £660,032 a year previously; and the gross expenditure £535,127, as against £509,700—leaving the gross profit £131,207, as against £150,332. The principal items of expenditure were £265,638 for coal (nearly £16,000 more than the previous year), £102,039 for repairs and maintenance of works, £27,156 for rates and taxes, £60,647 for wages, and £22,770 for salaries and establishment expenses. All these items show an increase on the previous year. Of the gross profit £54,083 went to pay annuities, £16,395 interest on stock, £5489 interest on mortgages and bonds, and £25,739 to the sinking fund. This leaves the net profit as stated above.

The Committee report the letting of the following contracts in connection with the Nechells extension: The New Conveyor Company, coal-elevating machinery, £7054; Messrs. Clayton, Son, and Co., retort-house roof, £7829; Messrs. Kirkham, Hulett, and Chandler, washer-scrubbers, £1860; Messrs. W. J. Jenkins and Co., washer, £245; Messrs. H. & T. Danks, boilers, £1040; Messrs. Westwood and Wrights, mouth-pieces, £2050; Messrs. Tannett, Walker, and Co., hydraulic machinery, £1080; Messrs. C. & W. Walker, condensers, £4391; and ironwork for retort-house, £10,914. After the presentation of the last report of the Committee, Messrs. Barnsley and Sons withdrew their tender for the erection of the new retort-house at Nechells. The Committee paid Messrs. Barnsley, on the measurements of the building surveyor, the value of the work which they had already done in preparing the site in anticipation of the formal completion of the contract. The Committee then offered the work to another firm, from whom the next lowest tender had been received in the competition, but were informed by them that, having regard to the advance which had subsequently taken place in the price of materials, they would be unable to undertake the work except at an addition to the tendered price. Having regard to the difficulties which it was apparent would arise in negotiating an advance on the tendered prices without a further competition, and to the extreme importance of not losing the time which such further competition would occupy, the Committee opened negotiations with Messrs. John Aird and Sons for the construction of the building at a fixed rate of profit to be added to the actual cost of the work, all materials to be purchased and the work to be carried out under the joint supervision of Messrs. Aird and Sons and the Engineer of the department. The Committee are glad to say that they were able to make satisfactory arrangements with Messrs. Aird and Sons on this basis, and that good progress with the work has been made. Subsequently the Committee included the smaller buildings—viz., boiler-house, purifier-house, exhauster house, and meter-house—in the contract with Messrs. Aird and Sons. The Committee have authorized an expenditure of £2250 on the reconstruction of a bench of retorts in No. 3 retort-house at Saltley; also an expenditure of £850 on the construction of a small gasholder at Swan Village, to be used in connection with the coal-testing plant at those works. Additions and replacements of the purifying plant now in use at Adderley Street have become necessary, and an expenditure of £4900 has been authorized on the work; and the tender of Messrs. Clayton, Son, and Co. for the purifiers at £4609 has been accepted. The Committee have also authorized an expenditure of £6138 on additional washers and purifying plant at Saltley and Windsor Street works. During the past winter it has been ascertained that the trunk mains supplying Yardley, Sutton Coldfield, and Darlaston are becoming insufficient for the purpose; and a further expenditure of £16,732 on enlarged mains for the supply of these districts, with the additional governor that will be required at the works in connection with them, has been authorized.

Among matters of minor importance, the report states that the Committee of the Technical School have accepted a suggestion that they should arrange a course of lectures in that school specially adapted to the requirements of gas-fitters and their apprentices. In order to assist the Committee of the school to obtain the services of a thoroughly qualified lecturer on the practical portion of the work, the Committee have made a donation of 15 guineas to the funds of the school, to be applied towards the payment of the fees of the lecturer. Having regard to the increased demand for coke and breeze, and the difficulties of keeping up the supplies required by consumers, a further advance of 1s. per ton was made in the price of these residuals as from Jan. 1 last. The rapid growth of the work of the department, and the issue of prepayment meters, has required the reorganization of the work of the rental office, after a shorter interval than has hitherto been usual. In connection with this work, it has been found necessary to make some further provision for the collection of accounts in the pay months; and the Committee are of opinion that, having regard to all circumstances, the most economical method of doing this is to extend the system of out-collections. At the nine post offices at which these collections are now made, about 5000 accounts were received in respect of the last December quarter, representing a collection of £5250. This collection is nearly equivalent to the work which one counter clerk would perform. Instead, therefore, of adding to the number of counter clerks, who are only engaged in the work of collection for four months of the year, the Committee are now making arrangements to extend the out-collection into other districts in which the accounts of small consumers are at present paid at the counter, and where the work has become excessive. The Committee are taking steps to provide Harcourt pentane photometers at the works.

HULL CORPORATION GAS SUPPLY.

A Good Year's Revenue—Reduction in Price.

At the Meeting of the Gas Committee of the Hull Corporation yesterday week, the Engineer (Mr. F. J. Bancroft) reported that the quantity of gas made during the year ending March 31 was 101,534,000 cubic feet; being 1,878,000 cubic feet in excess of the preceding year. The quantity of coal carbonized was 9487 tons; and the average yield, 10,311 cubic feet per ton. The amount of gas sold to private consumers was 80,314,600 cubic feet, against 77,330,000 for 1897-8; being an increased consumption of 2,984,300 cubic feet. The manufacture of gas had cost £118 in excess of the previous year, due to the extra cost of coal and purification; distribution expenses were £86 less; and an additional £55 had been spent on the public lighting. The sale of gas had resulted in an increased revenue of £429 from private consumption, while residual products had returned £163 more. The statement which was placed before the Corporation prior to the purchase of the works showed that the average net profit made by the old Company for 1892-3 was £4036. The balance carried to net revenue account amounted this year to £6147, against £4937 for the last year of the Company. After paying interest charges and the first instalment to sinking fund, the net profit amounted to £2509. The Chairman (Alderman Massey) thought they must regard the result as satisfactory; and he suggested that the Committee might now reduce the price of gas by 2d. per 1000 cubic feet. He said this would affect the revenue to the extent of £800; but the Committee had a margin of £2600. The recommendation was unanimously adopted.

WELLS (NORFOLK) GAS SUPPLY.

Decrease in the Receipts from Coke and Tar.

The proceedings at the last Monthly Meeting of the Wells (Norfolk) District Council revealed a regrettable state of affairs at the gas-works. It appears that, at a previous meeting, Mr. Kersley, a member of the Finance Committee, had called attention to the falling off in the receipts from the sale of coke and tar; and Mr. J. W. Richford, who fills the positions of Gas Manager and Collector, made a rather long report to the Council in reference thereto. He pointed out that the bed of six retorts was completely taken down early last May. Attention had been called to the ascension-pipes, which were made of various sizes. These became blocked, and threw great pressure on the retorts; causing them to carbon up and burst—thus losing gas. This matter, for some unexplained reason, was put off until the June meeting. An order was given for the retorts; but they were not received until the 17th of August, and they were not set until the 19th of September. In the meantime the hydraulic main was cleaned, which necessitated stopping gas making; and notice was given to consumers to use the gas as little as possible. After having the bed of retorts, he suggested that new ascension-pipes should be put in, with new arch-pipes. The work was given out on the 28th of September, and completed on the 9th of November; and about a week afterwards the bed of retorts was put into operation. All this time they had been working with defective retorts and bad ascension-pipes, which resulted in blocks, the bursting of a retort, and lids bursting open; and some members of the Council saw the gas under pressure blowing out of the lids of the retorts instead of passing up the ascension-pipes. Two fires had to be kept going for eight weeks; and as each fire consumed 13½ cwt. of coke per day of 24 hours, it was not to be wondered at that all the coke made was used in their own furnaces. During the eight weeks they consumed 37 tons 16 cwt. on one fire alone; the other fire burning quite as much. The heating up of the new retorts must also be allowed for. So close did they use up the coke made, that he had to refuse selling; and the man at the works had to sift breeze to make up enough for the fires. With regard to the tar, they used a lot for paving; and so low did they get that on the 2nd of August he had to refuse an order for 36 gallons. With regard to the falling off in the receipts for gas, if any, Mr. Richford said, this had been partly caused by the Council deciding to raise the price for heating and cooking purposes to the lighting rate, the result of which was that several consumers discontinued using gas for cooking, and they had two of the largest stoves lying idle at the works. Further, the consumers were nearly all using the incandescent burner. In conclusion, he urged that the bed of four retorts should be reset, and new ascension and arch pipes put in, as in the six retorts, which had given complete satisfaction, and answered admirably. At the same time, it would be advantageous to seriously consider the state of the gasholder. It was a very old one; and should there be a severe winter, and ice form round it, it was likely to fail. No good would come of shelving the question. Should the old one fail, the whole of the works would have to be closed, which would mean a loss to the ratepayers and bring ridicule upon the management. He trusted the explanation might be made as public as the statement previously recorded, which had a tendency to cause distrust and unpleasantness, which should not be, seeing that the collector was much underpaid for his services; the whole amount totalling to 9d. per day—not more than one hour's wages to a practical workman. The sale of coke and tar alone necessitated more than 3000 entries and three sets of books to keep, besides the 111 customers for gas, and the collection of £370 odd therefrom. Mr. Ramm characterized the statement of the Manager as a splendid defence and a very good explanation. Mr. Kersley maintained that the shortage in the receipts from the sale of coke and tar was a very serious one, and said it meant 2d. in the pound to the ratepayers. The Finance Committee expected to receive £100 from this source, whereas they only had £47. The receipts from coke and tar for the quarter ending March, 1898, were £38 15s. 6d.; and for the same period this year only £21 8s. 7d., or a little more than half. For the three months ending Dec. 31, 1897, they were £28 3s.; and for the corresponding period of 1898 they were only £15 8s. 11d. It was in the residuals that the great reduction had taken place. He did not blame anyone; he only wished to have a proper inquiry into the matter. After some conversation, in which additional explanations were given by Mr. Richford, the further consideration of the subject was adjourned.

BOMBAY GAS COMPANY, LIMITED.

The Ordinary Meeting of this Company was held last Thursday, at the London Offices, No. 6, Drapers' Gardens, Throgmorton Avenue, E.C.—Mr. CHARLES GANDON presiding.

The SECRETARY (Mr. J. H. Perrins) read the notice convening the meeting; and the report and accounts, of which a summary was given in the "JOURNAL" for the 2nd inst., were taken as read.

The CHAIRMAN said that, in the unavoidable absence of the Chairman of the Board (Mr. Robert Davidson), the duty devolved upon him of presenting the report and accounts. In doing so, he would first say that, considering the condition of Bombay, the accounts appeared to him to be satisfactory. When he said the "condition of Bombay," he referred principally to that dreadful scourge the plague, which had afflicted that city for so long a time. At the last meeting, the Chairman was in a position to express the hope that the worst had been passed, and that Bombay was then approaching its normal state. Unfortunately, this improvement had not been maintained; and, for some time past, the disease had been raging with increased severity. Their Manager, writing in August last, said there were 32 cases of plague per day reported, as compared with 8 in the corresponding month of the previous year; while in October there were 58 cases, as against 12. Furthermore, the Company had suffered by losing a considerable number of their employees; and there had been great difficulty in inducing the men to remain at their work. Seeing others running away from the city, they had an inclination to do the same. The latest information seemed to indicate that there was now a decrease; and probably with the coming hot weather there would be some improvement. The Board had had a letter before them that day which conveyed the intelligence that the present state was much the same as it was this time last year. In face of this deplorable condition of affairs, he must confess that he was surprised the balance-sheet showed such a decided improvement over that of the previous year. However, in comparing the two years 1897 and 1898, it must be borne in mind that the former contrasted unfavourably with 1896; so that, although the one before them showed an improvement over the preceding year, it did not perhaps compare very well with that for 1896. Turning to the accounts, on the credit side of profit and loss, there was a falling off of £540 in the public lighting. He was afraid he could not satisfactorily explain this. A reference to the matter in one of the Manager's letters seemed to imply that it was owing to a number of lamps not having been lighted in June last. But this, to his (the Chairman's) mind, scarcely seemed to account for it; and the Board had written for further details. The private rental presented the satisfactory increase of £1936, which was equivalent to about 7 per cent.; but in regard to this, they must take into consideration the fact that 1897 showed a falling off of 12½ per cent. compared with the previous year. Therefore, they had not really recovered the rental of two years ago. Coke, tar, and fittings exhibited a satisfactory increase. Then on the debit side of the accounts, coal had cost £597 less, notwithstanding that a larger quantity had been used; the reduction being due to the coal having cost 2s. 1d. per ton less on the average. Maintenance of retorts had cost £572 more. This was due to more renewals having been required during the year. Then there was an item "Passages, £198 15s." (which did not appear last year), owing to the change in the management. Exchange had increased by £1132, on account of more money having been brought over. With these exceptions, and a small item of £44 for law charges, the headings on the debit side of the profit and loss account all showed decreases; and the result was they had a balance of profit which was £1678 more than in 1897. At the last meeting the Chairman announced that Mr. Louis Penny had expressed a desire to retire from the service of the Company, and that Mr. F. W. Chamberlain, of Hull, had been appointed as his successor. This change took place in August last; and they had the pleasure of welcoming Mr. Penny among them that day. Personally, he regretted very much that Mr. Penny had retired; but he could quite understand that, after seventeen years in Bombay, Mr. Penny was desirous of taking his ease in a more temperate climate. The Board had every reason to believe that his successor would prove an efficient one. The balance of profit and loss account was sufficient to enable the Directors to recommend a dividend of 3 per cent., making, with the distribution in December last, 6 per cent. for the year. This was the same as it was in 1897; but then it was necessary to take £1255 from the reserve fund in order to pay it, whereas on the present occasion the profit allowed the payment of the dividend and the carrying forward of £423. The Chairman concluded by proposing the adoption of the report, and the declaration of the dividend recommended.

Major W. F. GORDON seconded the motion.

Mr. J. C. MAPPIN asked whether it was necessary to have such a large reserve fund as £15,450, and suggested the advisability of separating in future accounts the residuals from the fittings. He had been a shareholder for twenty years; and he did not see that there had been much improvement in the prosperity of the concern.

The CHAIRMAN, in reply, said that there was another way in which the reserve fund might be dealt with, as was done in some other companies—that was, by writing off each year a certain portion from the construction account. That had not been done in this Company; but instead the amount named had been put to reserve, so that, if necessity arose, recourse could be had to it. They might easily write off the £15,000 from construction account, because naturally the works and so forth were not now equal to what they were when first erected. Mr. Jones, he believed, would agree with him in that. [Mr. H. E. JONES: To some extent, yes.] Then the Board had to have recourse to it to make up the dividend on the last occasion. Regarding the item for residuals and fittings, it had been the practice to put them together from the commencement of the Company. He did not personally see any objection to stating them separately; but it was a very common way of putting the accounts in foreign companies. As to there having been no improvement in their property, he certainly must confess that was so. On the contrary, there had been a falling off. But in this connection they must bear in mind the plague and famine which had afflicted India in general and Bombay in particular. But in the business there had been an improvement—at any rate, they had not degenerated. Besides, there had been a great depreciation in the value of the rupee; and they had to charge a large amount to profit and loss on account of exchange.

Mr. LOUIS PENNY said this was the first time he had heard anyone complain of a Company having a large reserve fund; and, as to there having been no improvement, the private consumption was just double what it was fifteen years ago. If there had been a falling off in the dividend, it was due entirely to the drop in the exchange. Seventeen years ago, it was 1s. 8d. per rupee; at the present time it was 1s. 4d.; and it had been as low as 1s. 1½d.

The motion was unanimously carried.

On the proposition of Major GORDON, seconded by the CHAIRMAN, Mr. Robert Davidson was re-elected to his seat at the Board.

Mr. FREDERIC LANE LINGING, in proposing the re-election of Mr. Gandon, took the opportunity of cordially endorsing that gentleman's remarks concerning Mr. Penny. He regretted exceedingly the loss of the services of a man who had conducted himself so well, and had served the Company so faithfully.

Mr. H. E. JONES, in seconding the motion, said he could not give a full answer at the moment to the question the Chairman put to him when speaking of the reserve fund. Of course, the reserve fund would stand first to equalize dividend, and next to make good any accident or deterioration that might be discovered suddenly upon the works. But a gas-works which was repaired and renewed as it should be never decayed. A good reserve fund was a sheet-anchor in a concern of this kind. He agreed with Mr. Mappin that a little sub-division of the items in the accounts would be much better.

The motion was carried.

The CHAIRMAN having briefly responded on behalf of Mr. Davidson and himself,

The Auditors (Mr. E. A. Flinders and Mr. Magnus Ohren) were re-appointed.

Mr. PENNY, in proposing the usual complimentary vote to the Chairman and Directors, thanked Mr. Gandon and Mr. Linging for the kind way in which they had referred to him. Knowing something of the working of the Company's affairs in Bombay—having been until August last Engineer and Manager for seventeen years—he could congratulate the Board on the satisfactory result of the year's working. When they considered the fearful plague, and the depressing effect it had on everyone in Bombay, when the Manager never knew from day to day whether or not he would find himself without stokers and men to carry on the works, and when the trade of the whole city was paralyzed for want of labour, it was a matter for congratulation that the difficulties were only temporary and had been overcome. Great credit was due to the Manager and staff in Bombay, and to the Directors in London; for the purchasing of coal and the arranging of freights for the keeping up of a proper, but not too large, stock of coal on the other side played a most important part in the success or otherwise of the year's working. The chief thing to be borne in mind was that no false notion of economy should interfere with the maintenance of the quality of the gas. It was imperative that this should be kept up to the standard quality. The electric light, which was so common in the smallest towns on the Continent, had no standing in Bombay. The Welsbach burner, which was now fitted to nearly 4000 public lamps, had made Bombay the best lighted city of any in Her Majesty's dominions. So long as the Company retained the public lighting, and maintained it in its present state, there need be no fear of being troubled by electric light opposition. But they must not allow the illuminating power of the gas to be less than 14 candles, as, with the low pressure at which they necessarily worked in Bombay, the Welsbach burner did not give good results with low candle-power gas. Keep, he said, the private consumers satisfied, and reduce the price to them as soon as possible, and no fear need be felt for the future.

Mr. WHITLEY seconded the motion, which was heartily agreed to.

The CHAIRMAN having acknowledged the compliment,

Mr. WHITLEY moved a similar vote to the officers at home and abroad, including Mr. Penny. At the same time, he asked where the reserve fund was.

Mr. JONES, in seconding, pointed out that the Company had bank bills in hand and cash at bankers and in hand amounting to £9000, and sundry debtors to the extent of £12,600, which more than represented the amount of the reserve fund. The assets of the Company were shown in the accounts to be £266,391; while they had only raised £240,000—showing that they had £26,000 to the good.

The motion having been passed, the Secretary briefly responded.

GEORGETOWN (BRITISH GUIANA) GAS COMPANY, LIMITED.

The Half-Yearly Meeting of this Company was held last Tuesday, at the London Offices, No. 30, Gracechurch Street, E.C.—Mr. CHARLES GANDON in the chair.

The SECRETARY (Mr. Samuel Wood, F.C.A.) having read the notice calling the meeting, the report and accounts were submitted.

The CHAIRMAN first expressed regret that the report and balance-sheet for the past half year did not show more favourable results. As a matter of fact, there had been no real improvement since the last occasion on which he had addressed the shareholders. Turning to the accounts, it would be seen that there had been no increase in capital expenditure, for no extensions had been necessary. From the revenue account, it would be noticed that the profit for the half year was practically the same as that for the previous six months—to be exact, it was some £15 less. He might say that he was disappointed at this result, for he had really hoped there was to be some improvement. A glance at the accounts, however, would show why his hopes were not realized. Coals had cost £742, or an increase of £174 over the previous six months. This increase was chiefly due to the fact that it had been necessary to send out a cargo of 150 tons by steamer, instead of by sailing vessel, as usual. There had also been found a small deficiency in the stock, which had likewise been included in the accounts. The only other item on the debit side of the accounts to which he need call attention was repairs and maintenance of works, which came to £134 less than on the last occasion. The reason for this saving was that the mains had not needed so much attention. On the credit side, there was an increase of £42 in gas and meter rental, and

of £2 in the receipts for residual products. This was not a very large increase, it was true; and all that could be said of it was that it was better than a falling off. As he had just remarked, but for the increase in the cost of coals there would have been a more satisfactory balance. From the profit and loss account, it would be seen that there was an available balance of £45, after payment of interest on debenture bonds and temporary loans; and this was sufficient to enable the Directors to propose a dividend at the rate of 3 per cent. per annum on the preference shares. As to the future prospects of the Company, he was afraid to say much. He must confess he did not see any immediate chance of a great improvement, because the trade of the Colony was still in a very depressed condition. One thing, however, had occurred since the shareholders last met. A Canadian Syndicate had made arrangements to take over the local electric lighting undertaking and the tramways. He thought some benefit to the Company might arise from this, though he could not yet say exactly what it would be. A great cause of their depressed condition was the undue favour which had apparently been shown to the Electric Light Company in the matter of the public lighting. The contract was for five years, a considerable portion of which time had now elapsed; and he hoped that, on the expiration of the present arrangement, the Gas Company might receive more favourable consideration. The Chairman concluded by moving the adoption of the report and accounts.

Mr. Robert Berridge seconded the motion; and it was carried unanimously.

On the motion of the Chairman, seconded by Mr. H. W. Andrews, a dividend for the half year was declared on the preference share capital at the rate of 3 per cent. per annum, less income-tax, except on the dividends payable to shareholders in Georgetown.

The retiring Directors (Mr. Charles Gandon and Mr. G. Russell Garnett) and Auditor (Mr. Magnus Ohren) having been re-elected,

Mr. E. K. Blyth proposed a vote of thanks to the Directors, which was acknowledged by the Chairman.

A vote of thanks to the officers and staff in London and Georgetown, which was acknowledged by the Secretary, concluded the proceedings.

ELECTRIC LIGHTING NOTES.

The ratepayers of Maidenhead have lately been polled on the question of entrusting the management of the electric lighting of the town to the Corporation or to a company, with the following result: For the Corporation, 310; for a company, 118—majority for the Corporation, 192.

Last Thursday night the Mayoress of Carlisle (Mrs. White) formally switched on the electric current at the central electric lighting station in James Street in the presence of members and officials of the Corporation and others who had been invited to be present; thus inaugurating the electric lighting of the streets of the city where arc lamps have been erected and the illumination of those private establishments into which the light has been introduced. On the new installation, something like £25,000 has been spent, out of the £30,000 borrowed. The number of private consumers who have up to the present availed themselves of the light is not large.

There is certainly not unanimity in the Bootle Town Council on the question of the advantages of electric lighting for the town. At the meeting last Wednesday, when the motion was submitted for approving of the minutes of the Watch Committee, containing a recommendation that application should be made for further sums for the purposes of electric lighting and traction, Alderman Johnson moved the following amendment: "That it be an Instruction to the Watch Committee that no further expenditure in connection with the lighting by means of electricity in the public thoroughfares be authorized until a report has been presented to, and discussed by, the Council, showing (1) the amount already expended on street lighting by electricity, together with an estimate of the annual cost of the same; (2) the cost of lighting the same area with gas during the previous twelvemonth; (3) the cost of lighting the same area by incandescent gas, on the lines of the system adopted by the Lighting Committee of the city of Liverpool." He said he could not think the Committee could have had any conception, when they undertook to light the whole of the borough by electricity, of the tremendous burden they were about to put on the shoulders of the ratepayers. At the last Council meeting the Chairman of the Committee stated that on the next occasion the Committee would be prepared to submit a report with reference to the extension of the electric light. He believed this report had been prepared, discussed, and postponed, but had not yet seen the light of day. He hoped, in the interests of the ratepayers, that it never would see the light of day. They had sufficient material to go upon in the three roads already lighted with arc lamps. Here 36 arc lamps were in use, with incandescent lights attached. The cost per annum for utilizing each of these lamps, including the two incandescent lights, was £14 10s., without reckoning capital and other charges. This amounted, altogether, to £522 per annum. The whole quantity of gas consumed last year in the borough, with its 40 miles of streets, cost £2083, whereas they were spending on electricity one-fourth of this sum on one-fortieth of the same area. Were they to assume that the Committee intended to extend the electric lighting system over the whole of the borough? If so, it would cost something like £20,000, on the present basis, and would mean a 1s. or a 1s. 6d. rate. He did not think the system, if it illuminated the whole of the sky, would be worth it to the ratepayers at such a cost. He called it a course of absolute madness; and if the Committee persisted in it the whole town would be plunged into bankruptcy. He had been in a great many towns in various parts of England, and his opinion was that Liverpool had, during the last two or three years, become one of the best-lighted places in the whole of the country, not excepting London. This fact was due to a very large extent to the adoption of a system which, under the auspices of the former Lighting Superintendent, Mr. Bellamy, the Liverpool Corporation had adopted. He referred to the incandescent gas-light. He felt that, instead of rushing into any extravagant expenditure on electricity, it would be worth their while to consider the incandescent gas system now in use in Liverpool. Mr. Bell seconded the amendment. Mr. Musker supported it, and said he felt they were drifting into a very large expenditure. They needed further inquiry, and a full report as to the cost. Mr. Hall, while maintaining that the amounts for the moment involved need not frighten the Council, agreed that if the Committee were going to light every street in the borough with arc lamps, they would be making a gigantic mistake. Other members supported the amendment. Alderman Johnson mentioned that the capital cost of the arc lamps was £38 each, so that it would be seen how large an amount they would have to pay off in interest and depreciation without touching the cables. Alderman Platts remarked that the amendment would strengthen the hands of those members of the Committee who had been protesting against the extravagant expenditure. The amendment was carried.

BIRMINGHAM CORPORATION WATER SUPPLY.

Annual Report—Progress of the Welsh Scheme.

In their report to the Birmingham City Council, the Water Committee submit the accounts and balance-sheet for the year ending March 31 last. The water-rents show a total increase of 4·56 per cent. over the amount of the previous year. The increase is again in excess of that anticipated, although not so great as that of 1897-8. The cost of pumping, including maintenance of engines and boilers, is greater by £1781 than the corresponding item in the accounts of last year. The larger portion of this increase is due to the additional water pumped; and the balance is attributable to the increase in the price of coal. The new engine and boilers at Aston have not been in operation for a sufficient length of time to materially affect the cost, although there is already an appreciable reduction in the cost of pumping at that station. The depreciation of temporary works appears for the first time as an important item in the accounts, and will constitute, for the next few years, a serious charge on the revenue. In making this provision, the Committee are pursuing the policy of writing down the cost of all works in connection with the temporary extension of the present supply, at such a rate as will reduce them to a safe figure before the arrival of the Welsh water. The profit and loss account shows a balance of £15,408, which has been carried to the special water fund in accordance with the Act of 1892; making the total amount now standing to the credit of that fund £127,986. In accordance with the requirement of the Local Government Board, the Committee have, in conjunction with the Finance Committee, submitted to the Board a scheme for a revised sinking-fund table. The scheme comes into operation from the commencement of the present financial year, and will entail a considerable addition to the annual charge on the revenues of the department for sinking fund in respect of the capital under the Act of 1875. During the year £22,188 has been spent on local works. From this item £4608 is to be deducted as having been written off into revenue account; leaving a net sum of £17,580 added to capital expenditure on local account. Of this £13,169 represents extension of mains; the length laid during the year being over 17 miles. The use of hydraulic power is being gradually extended. Hitherto the operations of the high-pressure supply for hydraulic power have been carried on at a loss, which in the accounts now submitted amounted to £83 for the year, as against £411 for the previous year. The quantity of water distributed shows a considerable increase over the preceding year; the daily average having gone up from 16·178 to 17·213 million gallons. The number of houses in supply on March 31 was 146,190, which on a basis of five to a house gives a population of 730,950; being an increase of 22,995 over the number at March 31, 1898. The average gross consumption per head per day for all purposes works out at 23·92 gallons for the year, against 23·17 gallons.

Concerning the Elan supply works, the Committee report that the open winter having been favourable to out-door operations, satisfactory progress has been made with the building at the several dams. The amount expended on the works in the Elan Valley during the year was £183,408; making a total of £658,922. The total rainfall registered on the watershed for the year 1898 was 58·98 inches. Concerning the aqueduct, it is reported that contract No. 5 (Elan to Dolau, Messrs. John Aird and Sons) is now rapidly approaching completion. On contract No. 2 (Dolau to Knighton, Messrs. Morrison and Mason, Limited), the headings in the remaining section of the Dolau tunnel—viz., from Graig shaft to Bleddfa, comprising a length of 2 miles 33 chains—were joined up on Jan. 27 last. With the piercing of the Dolau tunnel, and of the Foel tunnel, the headings on all the principal tunnels on the aqueduct are finished. Other portions of the aqueduct, between Knighton and Hagley, are being pressed forward. Contract No. 13 (Hagley to Frankley) has been let to Mr. Abram Kellett, for the sum of £141,534 8s. This contract completes the line of the aqueduct, which is now let from end to end. In their report presented on May 17, 1898, the Committee referred to a contract that had been entered into with Messrs. Thomas Piggott and Co., Limited, of Birmingham, for steel pipes. At that time the contract was confined to the pipes of regular shape. The contract has now been extended to include all of the irregular and special pipes; the amount of the entire contract being £141,808. At Frankley, considerable progress has been made with the excavation for the reservoir and the erection of the east and division walls.

Improvements at the Driffield Gas-Works.—The Driffield Urban Council have decided to apply to the Local Government Board for power to borrow £3000 for alterations and improvements at the gas-works. Part of the loan is for cooking-stoves and prepayment meters.

Dearer Gas Coal and its Cause.—"One of the principal causes of the increased and still increasing price of gas coal," writes a Staffordshire correspondent, "is the determination of a large section of the miners not to work more than four days a week. By thus limiting the output, the miners are well aware that prices will naturally rise; and thus, under the sliding-scale, they will be able to claim an increase in the rate of wages. It cannot be denied, however, that this action is taking a mean and unfair advantage of the sliding-scale arrangement. Notwithstanding the extra selling price of coal, the difference in the matter of 'dead charges' between working four days and six days per week is very serious; but the loss ultimately falls upon gas companies and their customers, from the largest to the humblest consumer who buys his gas through a penny-in-the-slot meter. Considering the short hours of a miner's day, there ought to be some means of compelling him to do a reasonable week's work, or lose the advantage of the sliding-scale."

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Corporation of Dundee seem to approach the subject of the extension of their gas-works with something of the feelings of a child who sees a dose of physic in preparation for him. They are apprehensive, undecided, hesitating. If somebody else would take this cup from them, how relieved they would be! I do not think that the conduct of the Corporation Gas Department has improved since it was taken out of the hands of a separate Commission and came under the control of a Committee of the Town Council. The Gas Commissioners were a body with a single purpose; the Gas Committee have to enter into competition with other Committees of the Council. They are subject at all times to rivalry from those contemporary Committees—sometimes from the preferences, but more often from the prejudices, of leading members of the Council; and their proposals, as well as the motives for putting them forward, are frequently misunderstood by members who are ignorant, wilfully or otherwise. A Gas Manager cannot have the same freedom to work under such a body as he would have under a Committee who would have fewer subjects to occupy their attention, and probably greater ability for the transaction of business. At all events, in Dundee the Gas Committee conduct their affairs in such a way as to make the path of their head officials an unenviable one. There seems to be plenty of motion, but no advance. This week's programme consisted of a meeting which they did not finish, though it came to an end. There was a special meeting of the Town Council; but it was preceded by a meeting of the Gas Committee, which was called for the purpose of considering the plans for the reconstruction of the gas-works. The Committee had two sets of plans before them—one prepared by their own Manager (Mr. W. M'Crae), and the other by Mr. W. Foulis, of Glasgow. The first proposal made was that they do not agree to either of the plans till a Sub-Committee who had been appointed to consider Mr. W. M'Crae's report of Feb. 8 last should have given in their recommendations. As opposed to this, it was proposed that Mr. Foulis's plan should be adopted, and that he be asked to recommend an Engineer to prepare the requisite working drawings, and to state the remuneration such an Engineer would require. The Committee went on discussing these two proposals till 2.30; and then the Clerk reminded them of the meeting of Council called for 2 o'clock. At the Clerk's suggestion, the Committee then adjourned. At the close of the Council meeting, Lord Provost M'Grady forgot all about the Gas Committee; and by the time he was reminded of it, most of the members of the Committee had left, so that no further business could be done. It is certainly disappointing to see a Committee so undecided—so timid in taking a step which they well know must be taken. While they falter, their Manager cannot be expected to be robust. Drift, not progress, is the result of such vacillation as theirs.

Mr. Foulis's plan is described as consisting of a proposal to remove the coal-sheds in the west-end of the gas-works, and to erect on their site a gasholder of 3,100,000 cubic feet capacity; to erect another holder, of similar capacity, in the extreme north-west of the ground, to the eastward of the holders; to place lime-sheds on each side of a purifier-house running north and south; and further to the east, retort-houses, with benches of 480 and 384 mouthpieces respectively, and stores adjoining, capable of holding 19,000 tons of coal. This plan, so far as the gasholders are concerned, is said to follow Mr. M'Crae's proposals, but in the other matters his plan has been varied.

It is reported that the increased output of gas in Dundee during the past year amounted to more than 49 million cubic feet. It is expected that there will be no rise in the price of gas.

Few, I daresay, will be prepared to deny that representative Government is, theoretically, the ideal form of managing the affairs of the State or of the locality; but, in application, what a falling off there is from the ideal. The petty exactions that are imposed, or are sought to be imposed, by statute are well nigh intolerable. The liberty of the subject will soon be only a recollection. Where I live we are required by law to wash out the cisterns in our dwellings at stated intervals; and to see that we do it, an army of inspectors have been appointed, who are furnished with authority to invade residences, and, of course, to prosecute if their commands are not attended to to their satisfaction. A man may swindle with impunity, if he be a company promoter or director; but a poor person, if he asks a crust of bread, is sent to prison. Verily, administrative bodies of the elected sort are straining at the gnat and swallowing the camel. A very good illustration of the former was given in Leslie, a Fifeshire village, on Thursday. The place is dignified with the possession of a Police Court; and, will it be believed, the Provost and one of the Magistrates sat for the greater part of the day trying a charge against the Secretary of the local Gas Company of opening a public street without permission in writing, in contravention of one of the provisions of some grandmotherly Act of Parliament? The facts are that, it being necessary to make an opening, the Secretary wrote a letter to the Town Clerk stating that this was to be done. The matter was urgent; and, postal facilities being restricted, the Secretary gave a boy a penny to deliver the letter. The boy did not deliver it; and the Secretary, who had not been in the habit of receiving any reply to such communications, had the work proceeded with. No mason could be found to lay the paving, and the depression was filled up with sand for the night. This was looked upon as most heinous; and the Secretary was placed at the bar to answer for it. It was of no avail that his agent pleaded that the Gas Company, having made such openings in the streets for more than forty years, had a prescriptive right to do so (rather doubtful law, I should say), or that this was done without intent to offend. He was convicted, and a fine of 20s., with the alternative of ten days' imprisonment, was imposed. The fine was paid under protest; and the Company are considering whether they should appeal. There is a curious wrinkle in the proceedings, which I have not yet explained. This work was certainly done in good faith, and according to custom; the Town Clerk not being in the habit of replying to such requests. This should, of itself, have required the Bench, in honour, to have acquitted the accused. It being the custom not to grant written permission, the Municipality have been wrong in practice, as well as the Gas Company; and it is manifestly unfair—almost amounting to a corrupt administration of justice—to spring a mine upon the other wrongdoer. In civil law, one wrongdoer cannot recover from another. But the Court here got out of the difficulty by finding that it was not the Town Clerk, but the Burgh Surveyor, to whom application should have been made. I know that it is a dangerous thing to murmur a Judge, as it is called; but it was not the Judges who deserve censure here. They are subject only to the

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 1228.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Apl. 13	10½	Alliance & Dublin 10 p. c.	21½—22½	..	4 13 4
100,000	10	"	7½	Do. 7 p. c.	15½—16½	..	4 10 11
300,000	100	Jan. 3	5	Australian 5 p. c. Deb.	104—106	..	4 14 4
200,000	5	May 12	6	Bombay, Ltd.	6½—7*	..	4 5 9
40,000	5	"	6	Do. New, £4 paid	4½—5*	..	4 16 0
380,000	Stk.	Feb. 24	12	Brentford Consolidated	275—280	..	4 5 9
240,000	"	"	9	Do. New	215—220	..	4 1 10
50,000	"	"	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
159,375	"	Dec. 15	4	Do. 4 p. c. Deb.	128—133	..	3 0 2
220,000	Stk.	Mar. 29	11½	Brighton & Hove Orig.	265—270	..	4 5 2
296,320	"	"	8½	Do. A. Ord. Stk.	194—197	..	4 6 4
973,500	Stk.	Feb. 24	5	Bristol, 5 p. c. max.	125—130	..	3 16 11
430,000	20	Mar. 29	10	British	47—49	..	4 1 8
50,000	10	Feb. 24	12	Bromley, Ord. 10 p. c.	25—27	..	4 8 11
75,000	10	"	9	Do. 7 p. c.	20—22	..	4 1 10
500,000	10	Apl. 27	6	Buenos Ayres (New) Ltd.	10¾—11¼	..	5 6 8
220,000	Stk.	Dec. 30	4	Do. 4 p. c. Deb.	103—105	..	3 16 2
150,000	20	Mar. 10	8½	Cagliari, Ltd.	28—29	..	5 13 10
100,000	10	Sept. 29	7	Cape Town & Dis., Ltd.	13¾—14½	..	4 16 7
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	56—58	..	5 3 5
550,000	Stk.	Apl. 13	13½	Commercial Old Stock	312—317	+2	4 5 2
200,750	"	"	10½	Do. New do.	245—250	..	4 4 0
200,750	"	Dec. 15	4½	Do. 4½ p.c. Deb.	145—150	..	3 0 0
800,000	Stk.	Dec. 15	10	Continental Union, Ltd.	207—212	..	4 14 4
200,000	"	"	7	Do. 7 p. c. Pref.	187—192	..	3 12 11
51,600	Stk	Feb. 24	14	Croydon A 10 p. c.	305—310	..	4 10 4
168,400	"	"	11	Do. B 7 p. c.	255—265	..	4 3 0
555,000	Stk.	Feb. 24	5½	Crystal Palace Ord. 5 p.c.	130—135	..	3 17 9
60,000	"	"	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
486,090	10	Jan. 27	11	European, Ltd.	23—24	..	4 11 8
354,060	10	"	11	Do. £7 10s. paid	17—18	..	4 11 9
14,993,075	Stk.	Feb. 10	4⅞	Gas-light and Coke	4 p. c. Ord.	113—115	−1	4 5 3
2,500,000	"	"	3½		3½ p. c. max.	101—103	..	3 8 0
3,799,735	"	"	4		4 p. c. Con. Pref.	128—130	..	3 1 7
3,843,975	"	—	—		3 p. c. Con. Deb.	101—103	..	—
70,000	10	Nov. 11	8	Hongkong & China, Ltd.	14—15	..	5 6 8
3,800,000	Stk.	May 12	10	Imperial Continental	223—228*	+1	4 7 9
473,600	Stk.	Feb. 10	3½	Do. 3½ p. c. Deb. Red.	102—105	..	3 6 8
75,000	5	Nov. 30	6	Malta & Medn., Ltd.	5—5½	..	5 9 1
560,000	100	Apl. 4	5	Met. of 5 p. c. Deb.	111—113	..	4 8 6
350,000	100	"	4½	Melbourne 4½ p. c. Deb.	110—112	..	4 0 4
541,920	20	Nov. 11	5	Monte Video, Ltd.	15½—16½	..	6 1 3
617,946	Stk.	Feb. 24	9½	Newc'tle & Gatesh'd Con.	228—233	..	3 19 5
264,855	Stk.	Dec. 30	3½	Do. 3½ p. c. Deb.	107—110	..	3 3 8
				* Ex div.			

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
150,000	5	Nov. 30	8	Oriental, Ltd.	7½—7¾	..	5 3 3
135,000	5	"	8	Do. New, £4 10s. pd.	6½—6¾	..	5 6 3
15,000	5	"	8	Do. do. 1879, £1 pd.	1¾—1¾	..	4 11 5
60,000	5	Mar. 29	7	Ottoman, Ltd.	4½—5¼	..	6 13 4
500,000	100	Dec. 1	6	People's Gas of Chicago 2nd Mtg. Bonds	102—106	..	5 13 3
848,070	10	Apl. 27	7	River Plate Ord.	11½—12	..	5 16 8
250,000	Stk.	Dec. 30	4	Do. 4 p. c. Deb.	103—105	..	3 16 2
250,000	10	Mar. 29	10	San Paulo, Ltd.	16¼—17½	..	5 14 3
135,000	Stk.	Mar. 29	10	Sheffield A.	237—240	..	4 3 4
209,053	"	"	10	Do. B.	237—240	..	4 3 4
447,427	"	"	10	Do. C.	237—240	..	4 3 4
5,600,000	Stk.	Feb. 10	5½	South Metrop., 4 p.c. Ord.	139—142	..	3 15 1
1,460,000	"	Jan. 13	3	Do. 3 p. c. Deb.	101—103	..	2 18 3
—	—	—	—	Tottenham and Edmonton A.	—	—	—
—	—	—	—	Tottenham and Edmonton B.	—	—	—
182,380	10	Dec. 30	5	Tuscan, Ltd.	9—10	..	5 0 0
149,900	10	Jan. 3	5	Do. 5 p. c. Deb. Red.	99—101	..	4 19 0
				WATER COMPANIES.			
146,184	Stk.	Dec. 30	11	Chelsea, Ord.	318—323	..	3 8 1
150,000	"	"	5	Do. 5 p.c. Pref.	168—173	..	2 17 10
160,000	"	"	4½	Do. 4½ p.c. Pref. '75	150—155	..	2 18 1
175,785	"	Mar. 29	4½	Do. 4½ p. c. Deb.	156—160	..	2 16 3
1,720,560	Stk.	Apl. 13	7	East London, Ord.	218—222	..	3 3 0
654,740	"	Dec. 30	4½	Do. 4½ p. c. Deb.	156—159	..	2 16 7
390,000	"	"	3	Do. 3 p. c. Deb.	103—104	..	2 17 8
700,000	50	Dec. 15	7½	Grand Junction 10 p.c. max.	113—116	..	3 4 7
310,000	Stk.	Mar. 29	4	Junction 4 p.c. Deb.	135—140	..	2 17 2
708,000	Stk.	Feb. 10	14	Kent	360—365	+5	3 16 9
160,000	"	"	7	Do. New, 7 p. c. max.	210—215	..	3 5 1
1,043,800	100	Dec. 30	10½	Lambeth, 10 p. c. max.	300—305	..	3 8 10
406,200	100	"	8	Do. 7½ p.c. max.	230—235	..	3 8 1
350,000	Stk.	Mar. 29	4	Do. 4 p. c. Deb.	135—140	..	2 17 2
500,000	100	Feb. 11	13½	New River, New Shares	433—438	..	3 2 9
1,000,000	Stk.	Jan. 27	4	Do. 4 p. c. Deb.	137—142	..	2 16 8
902,300	Stk.	June 29	7½	Southwark and Vauxhall Ord.	215—220	..	3 8 2
126,500	100	"	7½		7½ p. c. max.	197—202	+2	3 14 3
489,200	Stk.	"	5		5 p.c. Pref.	168—171	..	2 18 6
1,019,585	"	Apl. 13	4		4 p. c. A Deb.	135—140	..	2 17 2
1,155,066	Stk.	Dec. 15	10	West Middlesex		302—307	..	3 5 2
200,000	"	"	4½	Do. 4½ p. c. Deb.		157—160	−2	2 16 3
200,000	"	Mar. 10	3	Do. 3 p. c. Deb.		102—104	..	2 17 8

comment that they might, in the exercise of their discretion, have dismissed the complaint. It was the Public Prosecutor who was responsible for this exhibition of bumbledom; but the Legislature are to blame for giving him the power to do it. The Secretary of the Gas Company is not a hardened criminal. No one was prejudiced by what he did. He was simply following a practice which, it had been discovered, was erroneous; and surely a friendly conference with him would have led to the correction of the mistake, which would have been a much more preferable method of righting a wrong than the placing of his name in the police-books of the burgh as a convicted person.

The Dunfermline Gas Commissioners, on resuming consideration of the proposal of Mr. Pooley, their Manager, to erect sulphate plant, and having obtained information regarding the working of similar plants in other towns, this week approved of it, but not quite unanimously. The figures obtained from other places show considerable diversities. The yield of sulphate varies from 21 to 28 lbs. per ton of coal; and the cost of working the plant per ton of sulphate is as low as £1 4s. 8½d. in one place, and as high as £4 5s. in another. As the season is now so far advanced, it was resolved to renew the contract with Messrs. James Ross and Co., of Falkirk, for the residual products made during next year; the contract price being 7s. 6d. per ton. The Committee fixed their coal contracts for next year. Their requirements were 8200 tons, divided into 2750 tons of first-class cannel or shale, 2500 tons of the jumbo nut class, and 2950 tons of splint or small nuts. There were 63 offers for 37,500 tons. The first class has been secured for a gross sum of £1868, the second for £1337, and the third for £1503. The price of the whole is £4608. The average is 11s. 2·91d. per ton, or 1s. 9½d. per ton higher than is being paid for the current year. Provost Scobie expressed disappointment at the rise in the price of coal, upon which Bailie Weir remarked that the rising tendency of prices indicated prosperity to the community, and he was certain they would not suffer in the least. The significance of this observation is that Bailie Weir is the Mr. John Weir who is the representative of the miners in Fifeshire. His views are, of course, their views. Mr. Weir is a moderate man of his class; and his remarks generally, as on this occasion, are well worthy of attention.

The Cowdenbeath Gas Company have presented an ultimatum to the Police Commissioners of the burgh, with reference to the account for gas consumed in the public lamps. Unless the account is paid by the 21st inst., the gas is to be cut off. The Police Commissioners this week resolved to pay for the proportion of oil gas which was used, but adhered to their former decision not to pay the full sum demanded for the acetylene gas with which the oil gas was mixed. In order to be ready for any emergency, they have given instructions to have paraffin lamps ready.

The Corporation of Stirling are feeling very sore over the reduction of the valuation of the undertaking of the Stirling Gas Company, which was made by the Assessor of Railways and Canals. A local newspaper twitted them with not having appealed; and, stung by these remarks, one Councillor, who has been antagonistic to the Gas Company all through, raised the question of why an appeal was not taken. The Town Clerk replied that the statute requires the Assessor of Railways and Canals to intimate the amount of his valuation to the Company, but not to the burgh. The Gas Company advertised their intention of having their undertaking valued by the Assessor of Railways and Canals; and the Town Council should have looked after the matter for themselves. The valuation must be completed before March 13 in each year; the roll is open for inspection to anyone interested; and appeals may be lodged up to April 10. This time is now past, and the right of appeal has expired. The valuation will hold good for the year from the 15th inst.; and the Corporation, if they wish it revised for another year, will require to be a little more on the alert. The reduction in the valuation is £338.

The Corporation of Galashiels, who began to agitate two or three months ago with reference to the want of light in the public streets, have now been convinced, through exhaustive inquiries, that it is the small quantity of gas which they burn, and not its bad quality, which is the reason of the light being poor. They have found out that in most places public lamps consume 3 cubic feet of gas per hour; whereas in Galashiels they only consume 2 cubic feet per hour. The present cost to the burgh is £200 a year; and if they were to add another foot, the outlay would be £300 a year. In these circumstances, the Corporation resolved this week to do nothing further in the matter.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *May* 13.

Sulphate of Ammonia.—There has been a strong market throughout the week, and a rapid advance towards the close; the quotations being £12 to £12 5s. per ton delivered f.o.b. at the ports. Supplies have been very scarce; and there has been great difficulty in covering immediate and early requirements. There has also been good demand for May-June delivery; and in this position makers have been able to realize very near prompt prices. Interest in the forward position is also well maintained; and up to £11 15s. per ton has been paid for July-October delivery f.o.b. Leith.

Nitrate of Soda is steady at 8s. per cwt. for fine quality on spot.

LONDON, *May* 13.

Tar Products.—Tar is realizing more money, owing to the better position of pitch and tar oils. This is an abnormal condition, as the chief value of tar in former years has arisen more from its finer products such as anthracene, benzol, &c. A somewhat firmer market characterizes anthracene; but there is no business of importance noted, although doubtless considerable quantities have changed hands during the past three months. Benzols are weaker; and the prospect is far from hopeful. Large numbers of new coke-ovens are being started; and others are approaching completion, causing the market to be deluged with offers of benzol. An excellent inquiry for carbolic acid exists, and value continues firm.

The average quotations for the week are: Tar, 15s. 6d. to 22s. 6d. Pitch, east coast, 27s. 6d.; west coast, 25s. Benzol, 90's, 6¾d.; 50's, 7¼d. Toluol, 10d. Solvent naphtha, 10½d. Heavy naphtha, 1s. Crude, 30 per cent., naphtha, 3d. Creosote, 3¼d. Heavy oils, 65s. Carbolic acid,

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60's, 2s. 1½d.; 75's, 2s. 9d. Creosote salts, 45s. Anthracene, nominal, "A," 4d.; "B," 3d.

Sulphate of Ammonia has rapidly improved in value during the past week; and business is possible at all ports at £12, less 3½ per cent. The market is strong; and higher prices are demanded by makers. Nitrate occupies a stronger position; and for once sulphate is undoubtedly lifting its value.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—A fair amount of business has been coming forward in gas coals during the past week; and several contracts have been settled, which afford some fairly reliable basis as to the probable prices for the present season. It may be stated that collieries have in every case held firmly for the minimum advance of 1s. 6d. per ton over last season's prices, in accordance with the resolution adopted by the Gas Coal Sales Association; and in some instances, where no advance was obtained last year over the 1897 prices, there is an upward move of 2s. per ton—making the general advance equal to this amount over the rates of two years back. The basis prices for the lower descriptions of screened gas coal—such as Wigan four-feet—on business done this week, would seem to be about 8s. 6d. to 9s. per ton according to quality; while for the best gas coals—represented by the Arley seams—9s. 6d. per ton would appear to be about an average figure, though for some special qualities as much as 10s. at the pit is being quoted. The satisfactory results which have followed the formation of the Gas Coal Sales Association would seem to have stimulated the Lancashire coal-owners to revive the general Coal Sales Association formed a few years back, but which ultimately collapsed. During the past week, a couple of meetings have been held with this object in view, and especially to regulate the conditions on which the contracts that are now coming forward from merchants for house-fire coals for the next twelve months are to be accepted. With regard to these contracts, a resolution has been provisionally adopted to the effect that colliery proprietors shall not enter into any forward engagements with merchants at fixed prices. Merchants, of course, would be in a position to buy forward to cover their prospective requirements; but this will be subject to prices being regulated, probably from month to month, in accordance with the current market rates when the deliveries are made. Generally a fairly active business is still coming forward in house-fire descriptions, which has been sufficient to take away the output; and with the approaching Whitsuntide holiday stoppages, which usually extend over a full week, collieries will be pretty well pressed to provide for the requirements of their customers during the temporary cessation of work at the pits. The position of collieries generally is that they have very little stock of any kind on the pit banks; and the probability is that during the ensuing summer they will be kept on full time in order to accumulate sufficient stock to meet the ensuing winter's requirements. This means that prices will be firmly maintained; while as a further advance in wages comes on in October, it is not improbable there may be some advance on current rates for next winter's trade. Steam and forge coals are also in brisk request, with rather a shortness of supplies; and prices are exceedingly strong at the full list rates. Engine fuel is coming in rather more freely from outside districts; but it is exceptional where Lancashire collieries have any surplus output to dispose of—most of them being still pressed to keep up with the requirements of customers. Prices remain very firm at recent quotations. Best Wigan Arley averages 12s. to 12s. 6d. per ton at the pit; Pemberton four-feet and seconds Arley 10s. 6d. to 11s.; common house coal 9s. 6d. to 10s.; steam and forge coal 9s.; best slack 6s. 6d. to 6s. 9d.; medium 5s. 9d. to 6s.; and common 5s. 3d. to 5s. 6d. Shipping has been only moderate, with steam coals averaging 9s. 6d. to 10s. per ton delivered at Mersey ports. For coke there is a very brisk demand, with a scarcity of supplies. The Lancashire makers of the best foundry cokes have formed an association for the regulation of prices, which are steadily hardening. For delivery into trucks, 21s. per ton has been readily obtained for best foundry coke; while for local sales, prices rule as high as 23s. at the ovens, and ordinary furnace cokes range from 15s. to 16s.

Northern Coal Trade.—There has been some irregularity of late in the coal trade of this district, partly due to the variation of the demand from other countries. The Baltic ports are now open; and this allows of more outlets for coal. Best Northumbrian steam coals are about 12s. 10½d. per ton f.o.b., second-class steam coals are steady at 12s., and steam smalls are 7s. 3d. Manufacturing coals are very firm, and in strong demand; the factories being fully employed. In the gas coal trade, there has been the receipt of tenders for the chief local contract—that of the Newcastle Gas Company—and it is no secret that these are at a considerable advance on the rates that have ruled under the contracts nearing an end; but the exact prices have not transpired. For occasional cargoes, the quotation for best Durham gas coals is from 9s. to 9s. 6d. per ton f.o.b. Gas coke prices are unchanged this week.

Scotch Coal Trade.—Large outputs continue to find a ready market, at practically unchanged prices. The home demand continues to improve, and is likely to remain strong. The foreign demand has not developed as expected, but seems to be going back week by week. The prices quoted are: Main 9s. to 9s. 3d. per ton f.o.b. Glasgow, ell 10s. 3d. to 10s. 9d., and splint 9s. 9d. to 10s. The shipments for the week amounted to 194,169 tons—an increase of 3751 tons upon the previous week, but a decrease of 20,746 tons upon the corresponding week of last year. For the year to date, the total shipments have been 2,651,677 tons—a decrease of 76,218 tons compared with the same period of last year.

The Colwyn Bay District Council and the Gas-Works.—The Colwyn Bay and Colwyn District Council have authorized the Finance Committee to approach the Colwyn Bay and District Gas Company, with the view to the purchase of their undertaking, under the provision of section 77 of the Colwyn Bay and District Gas Act, 1896. The Chairman (Mr. G. Bevan) said he brought the matter forward because, under the Act cited, there were only two of the five years left in which the Council could purchase the works by arbitration without opposition by the Company.

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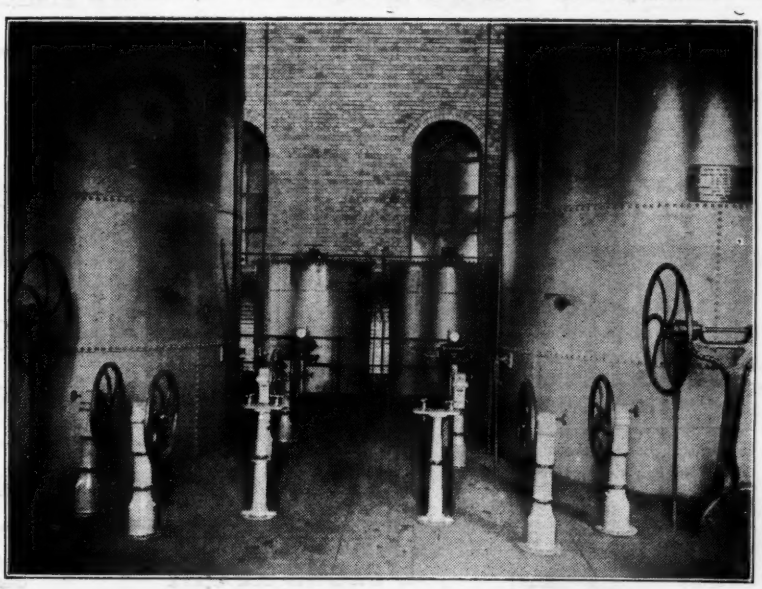

RESULTS PROVE EFFICIENCY.

Working Floor of Generator House. One Quarter Section of Birmingham Plant, Windsor Street Station.
The Maximum Daily Capacity of the Birmingham Corporation's Plant, which was erected by this Company, is 10 MILLION CUBIC FEET.

Southport Corporation Gas Supply.—The profits of the gas undertaking of the Southport Corporation for the year 1898-9 are put at £15,147, compared with £6516 and £8839 in the two preceding years.

Willesborough Water Supply.—The Willesborough District Council have decided to adopt the scheme of Mr. Bailey Denton for providing a water supply for Willesborough at an estimated cost of £11,000; and application is to be made to the Local Government Board for permission to borrow this sum.

South African Lighting Association, Limited.—The report of the Association for the year 1898, to be presented at the meeting called for to-morrow, states that a dividend of 10 per cent. for the year will be paid, including the interim dividend paid in October last. A sum of £2500 will be transferred to the reserve account; £1000 to the plant depreciation account; and £3692 will be carried forward. The consumption of gas at Port Elizabeth and Grahamstown shows a satisfactory increase.

Gas Lighting at Martock.—The retorts at the works of the Martock and District Gas Consumers' Company were charged for the first time on the 19th ult. The residents will now, as a local paper says, be enabled to "enjoy light instead of darkness—a boon for which many have been longing for upwards of fifty years." It appears that several ineffectual attemps have been made to bring gas into Martock; but it is now an accomplished fact, through the foresight of Mr. W. A. Padfield, of Exeter, assisted by an energetic Board of Directors. The work has been carried out under the supervision of Mr. James Browne, of London.

Results of the Regenerative Retort Settings at Evesham.—In proposing the adoption of the report of the Gas Committee at the meeting of the Evesham Town Council last Wednesday, Alderman Lowe stated that previous to the introduction of the new regenerative settings they made 9880 cubic feet of gas per ton of coal carbonized; but they now produced 11,446 cubic feet per ton. In 1896 they paid £239 as carbonizing wages to make 18 million feet of gas; but in 1898 they spent £209 to make 22 millions. They were using rather dearer coal; but they had made a profit of £500 during the year more than would have been possible under the old arrangement.

Sale of Stocks and Shares.—At the Mart, Tokenhouse Yard, on Monday last week, Mr. Alfred Richards conducted a successful sale of stocks and shares. Some 4 per cent. perpetual debenture stock of the Lowestoft Water and Gas Company fetched an average of £121 18s. 10d. per £100; yielding the purchaser £3 5s. 8d. per cent. Some additional ordinary shares of £10 each in the same Company were sold at an average of £14 14s. 6d. each; yielding £3 11s. 4d. per cent. A few £10 "B" shares in the Eastbourne Gas Company fetched, on an average, £26 9s. each; yielding £4 6s. 11d. per cent. A new issue of consolidated ordinary stock of the Enfield Gas Company found purchasers at an average of £107 17s. per £100; returning them £4 12s. 8d. per cent. Some consolidated preference stock (£13) of the Company was sold for £17; yielding £3 16s. 6d. per cent. A parcel of 500 £10 shares (new issue) in the Southend Water Company were sold at an average of £15s. 11s. 9d. each; yielding £3 10s. 6d. per cent. The amount realized was £21,098 15s.

The Price of Gas at Malton.—A reduction of 3d. per 1000 cubic feet has been made in the price of gas by the Malton Gas Company; but concurrently therewith the Company are imposing a charge for meters, varying from 9d. to 2s. a quarter, and discontinuing the rebates on consumptions of 50,000 cubic feet per quarter and upwards.

The Award in the Kettering Water-Works Arbitration.—The amount the Kettering Urban District Council will be called upon to pay for the purchase of the works of the Water Company was made known on Tuesday. The award of the Umpire (Mr. Edward Wood) fixes £127,880 as the value of the undertaking. Besides this there are the debentures, amounting to £11,000; and if these are taken over, the costs and everything will reach £140,000, which sum will have to be raised by a loan to be repaid in fifty years. When the Company approached the Council, the price suggested was £175,000; so that the Local Authority have got the works for £50,000 less. Generally, the award has been received with satisfaction.

The Worthing Gas Company have given Messrs. Biggs, Wall, and Co. an order for one of their "Rapid" charging-machines.

The Boston Spa Gas Company, Limited, have placed with Messrs. R. Dempster and Sons, Limited, of Elland, an order for extensions to their carbonizing plant.

Messrs. W. J. Jenkins and Co., Limited, of Retford, have received an order for a Livesey washer, having a capacity of 4 million cubic feet per diem, for the Gaythorn works of the Manchester Corporation.

The Gas Committee of the Burnley Corporation have accepted the tender of Messrs. Hardman and Holden, Limited, for the surplus tar produced at the gas-works during the year ending March 31, 1900, at the price of 24s. 3d. per ton.

Messrs. W. C. Holmes and Co., of Huddersfield, have received from the Wombwell Urban District Council the whole of the contract for the extensions to be carried out at their works; comprising a telescopic gasholder, gasholder tank, purifying-house, purifiers, lifting apparatus, centre-valve, connections, &c.

The following exhibitions of gas appliances have lately been held: By Messrs. Arden Hill and Co., at Shepherd's Bush, Manchester (Alexandra Park), and Tenterden. By Messrs. Fletcher, Russell, and Co., at Stockport, with lectures by Mrs. Fennah. By Messrs. R. & A. Main, Limited, at Arbroath, with lectures by Miss Griggs; at Marsh, with lectures by Miss Sanderson; and at Southport, with lectures by Miss Baines. By Messrs. C. Wilson and Sons, at Armley (Leeds) and at Milnsbridge, with lectures by Miss Holroyd. By Messrs. John Wright and Co., at Chertsey, Edinburgh, and Truro, with lectures by Miss Ball, Miss M. B. Terrace, and Mrs. Marshall. The Davis Gas-Stove Company, Limited, held an exhibition, under the auspices of the Ventnor Gas and Water Company, in the Friendly Societies' Hall in the town last week, with lectures by Miss Amy Wilkinson. In the little Somersetshire town of Martock, Messrs. Fletcher, Russell, and Co. lately held an exhibition—the first of the kind—with lectures by Miss Rose Brown.

R. & A. MAIN, Ltd.

Argyle Works, GLASGOW.

Telegrams: "GASMAIN, GLASGOW."

109, Farringdon Road, LONDON, E.C.

Telegrams: "GASMAIN, LONDON."

BRISTOL:
28, BATH STREET.
Telegraphic Address: "GOTHIC."

BIRMINGHAM:
1, OOZELLS STREET.
Telegraphic Address: "GOTHIC."

MANCHESTER:
87, BLACKFRIARS STREET.
Telegraphic Address: "GOTHIC."

THE

"Main" Cooker,

With Enamelled Grids and Shelf Guides.

SEVERAL COLOURS OF ENAMELLED LININGS.

Prices from - - £4 12s. 6d.

NEW SEASON'S LIST NOW READY.

WHITSUN HOLIDAYS.

NOTICE TO ADVERTISERS.—In consequence of the **WHITSUN HOLIDAYS**, orders with respect to **ADVERTISEMENTS** should be received at the Office *not later* than **THE FIRST POST ON SATURDAY NEXT.**

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale than all other Oxides combined. Purity and uniformity of quality guaranteed.

JOHN WM. O'NEILL, Managing Director,
160, 161, & 162, PALMERSTON BUILDINGS,
OLD BROAD STREET,
LONDON, E.C.

ANDREW STEPHENSON, AGENT. All communications *re* Oxide to the Company as above.

WINKLEMANN'S ORIGINAL "VOLCANIC" FIRE CEMENT and "VOLCUM" PASTE. Always ready for use in GAS-WORKS. Resists 4500° Fahr.

ANDREW STEPHENSON,
182, Palmerston Buildings,
Old Broad Street, E.C.
"Volcanism, London."

SADLER & CO., Ltd., Middlesbrough, Tar Distillers and Tar Colour Manufacturers. BENZOL specially prepared for Gas Enrichment free from Sulphur. Pure Hydrated OXIDE OF IRON for Purifying Gas either for Sale or Lent on Hire. Always Buyers of GAS TAR and AMMONIACAL LIQUOR.

BROTHERTON & CO.
Offices: Commercial Buildings, LEEDS. Correspondence invited.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER LINCOLN."
[For Illustrated Advertisement, see May 9, p. 1182.]

SULPHURIC ACID for Sale.
BROTHERTON AND CO., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

NEW GAS PLANT CEMENT.
JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.
For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

PATENTS FOR INVENTIONS.
Messrs. J. C. CHAPMAN & CO., Chartered Patent Agents, ADVISE ON ALL MATTERS CONNECTED WITH ABOVE.
Information and Handbook on application.
70, CHANCERY LANE, LONDON, W.C.

AMMONIACAL LIQUOR wanted.
BROTHERTON AND CO., Ammonia Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

IMPORTANT.
REPAIR your old Retorts with Patent STICKFAST FIRE CEMENT. Unequalled for Repairing Inclines. Estimates for all kinds of Retort-Settings.
Write CROWTHER, Retort Setter, and Sole Maker of Stickfast Fire Cement, Manor Street, HUDDERSFIELD.

GAS TAR wanted.
BROTHERTON AND CO., Tar Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

GAS CARBON Wanted, not less than 4-Ton Loads.
Apply to the BRIMINGTON CARBON COMPANY, Sowerby Bridge, YORKS.

PRACTICAL RETORT SETTER.
GEORGE NUTTALL, 32, Havelock Road, Saltley, Birmingham.
Regenerator or other Furnaces erected to Engineers' own Designs. Best Work Guaranteed. Please write for Estimates.

SPENT OXIDE wanted.
BROTHERTON AND CO., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SULPHATE OF AMMONIA SATURATORS.

JOSEPH TAYLOR & CO., Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c., CENTRAL PLUMBING WORKS, TOWN HALL SQUARE, BOLTON. Special attention to Repairs.
Before placing Orders, please write for Estimate.
Telegraphic Address: "SATURATORS, BOLTON."

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM; and 45 & 47, Westminster Bridge Road, LONDON, S.E.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Addresses:
"Braddock, Oldham." "Metrique, London."

SULPHURIC ACID.
JOHN NICHOLSON & SONS, Limited, Chemical Works, Leeds, specially produce this ACID from SULPHUR, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

HYDRATED OXIDE OF IRON.
PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Lent on Hire.
Can be Exchanged for Spent Oxide.
READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

RE GAS STOKER—DARTMOUTH GAS COMPANY.
THANKS to Applicants. The Vacancy is FILLED.
J. TALL,
Manager.

EFFICIENT Fitter seeks Situation. Competent to undertake any branch in Fitting Department—Main, Service, Inside Fittings, and Meters—with practical Experience.
Address No. 3275, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a practical Working Manager the MANAGEMENT of a Gas-Works, where the make is from 15 to 20 Millions, or Outside Superintendent of a larger Works. Has held present position five-and-a-half Years. A change desired.
Address No. 3274, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

DRAUGHTSMAN Wanted. One accus- tomed to detailing Gas Apparatus preferred.
Apply, stating Age, Experience, and Salary required, to R. DEMPSTER AND SONS, LIMITED, Elland, YORKS.

WANTED, at once, a Good Gas- FITTER. Used to House Work, Iron, Compo, &c., and to Main and Service Laying. State Age and Wages required. Permanency.
Apply to R. WATSON, Gas-Works, HERTFORD.

WANTED, a Man for Sulphate Making Must be capable of working the Continuous System, and willing to make himself useful in a Gas-Works. Wages 33s. per week to a capable Man.
Apply to the GAS COMPANY, Richmond, SURREY.

MAINLAYER wanted, to lay about 700 yards of 3-inch Main.
Write, stating Experience and Wages required, to No. 3273, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Young Man as Draughts- man by a Firm of Constructional Gas Engineers. Must especially be well up in taking out quantities.
Apply, by letter, stating Age, Experience, and Wages required to No. 3272, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, two Carbonizing Foremen, accustomed to Regenerative Furnaces and Inclined Retorts.
Apply, by letter, enclosing *copies* of three recen Testimonials as to Character and Abilities, to No. 3227, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ROTHERHAM GAS-WORKS.
WANTED, immediately, a thoroughly capable FOREMAN. Experience of Inclines and Regenerators essential. Wages £2 per week. Eight-hour Shifts. Apply to
FRANK A. WINSTANLEY,
Engineer and Manager.

WANTED, immediately, a smart active Man as WATER-FITTINGS and WATER-WASTE INSPECTOR. Must have a good knowledge of Water-Fittings and Plumbing, and be able to do small repairs if required.
Applications, with References and Salary required, to be made to the MANAGER, Water and Gas Company, Gas-Works, BEXHILL.

WANTED, a second-hand Circular Cast- IRON TANK, constructed of Flanged Plates, in good order. Any size between 25 and 40 feet diameter and 10 and 20 feet deep.
Apply, by letter, with Particulars and Price, and where can be seen, to No. 3271, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SEASON 1899.
BALE'S OXIDE OF IRON, of finest Quality. Summer delivery specially recommended for efficiency and economy.
FIRE CEMENT, PAINT, and CHEMICALS.
120 and 121, NEWGATE STREET, LONDON, E.C.

TO GAS AND WATER OFFICIALS.
CYCLES of the Highest Quality at reasonable Prices. Catalogue, post free. For CASH, or on GRADUAL PAYMENT SYSTEM. *Sent on approval. Twelve Months' Guarantee.*
MELROSE CYCLE COMPANY, COVENTRY.

CANNEL, COAL, ETC.
JOHN ROMANS & SON, EDINBURGH, Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, / NEWTON GRANGE, NEWBATTLE, DALKEITH, } SCOTLAND.

SHEFFIELD CHEMICAL COMPANY, LIMITED.
BUYERS of Spent Oxide. Sellers of OXIDE OF IRON and SULPHURIC ACID.

FOR SALE—One 8-inch Dry-Faced Four- WAY VALVE, by Cockey, two Sets of RETORT MOUNTINGS complete for Beds of Sixes, 15-inch Circular RETORTS, including Hydraulic, Mains, Valves, &c.
For Prices and Particulars apply to the undersigned.
H. WIMHURST.
Gas-Works, Sleaford.

FOR DISPOSAL—One Round Station METER, 10,000 Cubic Feet capacity, by W. Parkinson and Co., London. Will be sold cheap. Also a large quantity of 3-feet CAST-IRON PIPING, Straight Lengths, Bends, &c. Has never been used. Can be seen here at any time by appointment.
JOHN RILEY AND SONS, Hapton, near ACCRINGTON.

FOR SALE, cheap—
Two PURIFIERS, 8 ft. square by 4 ft. deep.
Two " 5 ft. " 4 ft. "
One " 5 ft. " 3 ft. "
One EXHAUSTER, 20,000 Cubic Feet per hour.
Two " 5000 " " "
Also CONDENSERS, SCRUBBERS, WASHERS, GASHOLDERS and TANKS, VALVES, &c., &c.
Apply to SAML. WHILE AND SON, 60, Queen Victoria Street, LONDON, E.C.

THE Wolverhampton Gas Company have FOR SALE, at their Horsley Fields Works, the following SECOND-HAND PLANT comprising: Retort-Fittings, Two Exhausters, Two Steam-Engines, Two Boilers, Two Sets of Vertical Cast-Iron Condensers, Two Scrubbers about 25 ft. by 7 ft., Station Meter, Governor, Cast-Iron Tanks, Weighing-Machine, Roof Principals, &c.
The above can be seen by appointment.
For further Particulars apply to the MANAGER, Gas Company, WOLVERHAMPTON.

FOR SALE, at the Yeadon Gas- Works—
∩ MOUTHPIECES, 19 in. by 14 in.; Lids, Cross-Bars, &c., complete.
ASCENSION, ⊢, and DIP-PIPES, 5-inch.
Wrought-Iron HYDRAULIC MAIN, 29 ft. long, and 14 ft. 6 in. long, 20 in. by 18 in.; also one length, 14 ft. 7 in. long, 21 in. by 17 in., all ∪-shaped.
Five lengths of Cast-Iron HYDRAULIC MAIN, 7 ft. 6 in. each, 18 in. by 18 in.; also
Five lengths of Cast-Iron HYDRAULIC MAIN, 7 ft. 3 in. each, 20½ in. by 16 in., all ∪-shaped, the whole arranged for Five Retorts in a Setting.
FURNACE FRAMES, DOORS, BUCK-STAVES, &c., &c.
For further Particulars, apply to the MANAGER, Gas-Works, Yeadon, LEEDS.

THE Pinner Gas Company, Limited, in- vite OFFERS for the following surplus PLANT:
The IRONWORK of a bed of Seven Retorts, including Seven ∩ 21 in. by 15 in. Self-Sealing MOUTHPIECES and LIDS (C. & W. Walker's Patent), Seven 6 in. to 4 in. ASCENSION-PIPES, Seven ARCH PIPES, with Anti-Dip Valves, Levers, and Weights, one length of CAST-IRON HYDRAULIC MAIN.
One 4-inch Cast-Iron Vertical PIPE CONDENSER, with bottom box complete.
One Wrought-Iron TOWER SCRUBBER, with C. & W. Walker's patent Washer in bottom and Water-Tank at top, 8-inch Valves and Connections.
The whole has been removed to make room for larger Plant.
For further Particulars apply by appointment to the MANAGER, Gas Company, Pinner S.O., MIDDLESEX.

FARNWORTH AND KEARSLEY GAS COMPANY.
THE Directors of the Farnworth and Kearsley Gas Company are prepared to receive TENDERS for the surplus TAR and AMMONIACAL LIQUOR produced at their Works, together or separately, for One Year.
Sealed Tenders, addressed to the Chairman, J. W. Watkinson, Esq., to be delivered on or before Wednesday, May 24.
Forms of Tender or any further Information required may be obtained from the undersigned.
THOMAS LEA SHEPPARD,
Manager

THE Llandudno Urban District Council invite TENDERS for the Purchase of the AMMONIACAL LIQUOR and TAR to be made at the Llandudno Gas-Works during a period of Twelve Months next ensuing.

Tenders must be sent in to the undersigned on or before the 6th of June next, endorsed "Liquor and Tar."

ALFRED CONOLLY,
Clerk to the Council.

May 18, 1899.

THE Llandudno Urban District Council invite TENDERS for the supply of 6000 Tons of best screened GAS COAL, capable of producing a minimum of 10,000 cubic feet of 18-Candle Gas per ton, to be delivered, carriage paid, between the 1st of July next and the 30th of June, 1900, at the Llandudno Station of the London and North-Western Railway in such quantities, and at such periods as may be ordered from time to time.

Forms of Tender may be obtained on application to the undersigned; and only such Tenders as are upon the prescribed Form will be considered.

In every case where the Particulars asked for are not given, the Tenders will be thrown out and not considered.

Tenders must be sent to the undersigned not later than the 6th day of June next.

The Tender of any person or Firm, who personally, or through an Agent, canvasses any of the Officers or Members of the Council will be rejected.

The Council do not bind themselves to accept the lowest or any Tender.

ALFRED CONOLLY,
Clerk to the Council.

May 18, 1899.

GOOLE URBAN DISTRICT COUNCIL.

(GAS AND WATER DEPARTMENT.)

THE Goole Urban District Council are prepared to receive TENDERS for the following, supplied and erected complete at their Doyle Street Gas-Works, Goole:—

Three Beds of Six Ω RETORTS (Regenerator Principle), complete, with Subway, Lift, and Retort Mountings.

STEEL GIRDERS and other IRONWORK for Covering in Tar and Liquor Underground Tanks.

CAST-IRON COLUMNS and STEEL GIRDERS for alterations to Retort-House.

Drawings, Specifications, &c., may be seen at the Engineer's Office, Gas-Works, Goole.

Sealed Tenders, endorsed "Tender for Retort-Bench," "Girders, &c., for Tar-Tank," or "Retort-House Columns and Girders," to be addressed to Geo. England, Esq., Clerk to the Council, Exchange Buildings, Goole, not later than Twelve o'clock noon, on Saturday, the 27th day of May, 1899.

The Council do not bind themselves to accept the lowest or any Tender.

By order,
MATT. DUNN, M.Inst.Mech.E.,
Engineer and Manager.

Gas Works, Goole,
May 4, 1899.

TO TAR DISTILLERS AND OTHERS.

THE Corporation of Birkenhead invite OFFERS for the purchase and removal of the SURPLUS TAR produced at their Gas-Works during a period of One, Three, or Five Years, commencing on the 1st of July, 1899.

Deliveries will be made at the Gas-Works either into Contractor's Tanks on the Gas-Works Railway Siding or into Tanks for conveyance by road to Boats.

The Contractor whose Tender is accepted will be required to enter into a formal Contract or Agreement with the Corporation, upon the specific terms and conditions contained in the Draft Contract which has been prepared by the Town Clerk, and deposited in his Office for inspection.

Forms of Tender and further Particulars may be obtained from the Gas Engineer, Mr. T. O. Paterson, C.E., Gas-Works, Thomas Street.

Tenders, which must be on the printed form supplied, sealed and endorsed "Tender for Tar," to be sent in to me not later than Five p.m. on Friday, the 26th of May, 1899.

The Corporation do not bind themselves to accept the highest or any Tender.

By order,
ALFRED GILL,
Town Clerk.

Town Hall, Birkenhead,
May 4, 1899.

TO MANUFACTURING CHEMISTS AND OTHERS.

THE Corporation of Birkenhead invite OFFERS for the purchase and removal of the AMMONIACAL LIQUOR produced at the Gas-Works, for a period of One, Three, or Five Years, commencing on the 1st of July, 1899.

A pipe is laid between the Gas-Works and the River Mersey for the conveyance of Liquor into the Contractor's Boats, or, if desired, the Corporation will provide appliances on their own Railway Siding to pump the Liquor direct into the Contractor's Tank-Waggons.

The Contractor whose Tender is accepted will be required to enter into a formal Contract or Agreement with the Corporation, upon the specific terms and conditions contained in the Draft Contract which has been prepared by the Town Clerk, and deposited in his Office for inspection.

Forms of Tender and further Particulars may be obtained from Mr. T. O. Paterson, C.E., Gas Engineer, at the Gas-Works, Thomas Street.

Tenders, sealed and endorsed "Tender for Ammoniacal Liquor," to be sent in to me not later than Five p.m. on Friday, the 26th of May, 1899.

The Corporation do not bind themselves to accept the highest or any Tender.

By order,
ALFRED GILL,
Town Clerk.

Town Hall, Birkenhead,
May 4, 1899.

WADEBRIDGE WATER-WORKS.

TO CAST-IRON PIPE MANUFACTURERS.

THE Wadebridge Urban District Council are prepared to receive TENDERS for the supply of about 350 Tons of 6-inch, 4-inch, and 3-inch CAST-IRON PIPES.

For Specifications and Conditions apply to Mr. Geo H. Harris, Engineer, Wadebridge, Cornwall.

A deposit of £2 2s. will be required with each application, to be returned on a *bonâ-fide* Tender being received.

The Council do not bind themselves to accept the lowest or any other Tender.

WALTER O. WELLINGTON,
Clerk to the Council.

Dated Wadebridge,
May 13, 1899.

TENBY GAS CONSUMERS' COMPANY, LIMITED.

PURIFYING PLANT.

THE Company are prepared to receive TENDERS for the supply and erection of Four 12-feet Square PURIFIERS, complete with STAGING, LIFTING APPARATUS, 10-inch WECK'S PATENT CENTRE-VALVE, and IRON ROOF for Shed, 76 ft. by 24 ft.

Plans and Specifications may be seen on applying to the undersigned.

Tenders, endorsed "Purifiers," to be addressed to the Secretary of the Company, C. W. R. Stokes, Esq., and to be sent in on or before the 24th inst.

ALFRED H. BROOKMAN,
Engineer and Manager.

Gas Offices, Tenby.

RHONDDA URBAN DISTRICT COUNCIL.

(GAS AND WATER DEPARTMENT.)

TENDERS FOR COAL AND PIPES.

THIS Council are prepared to receive TENDERS for the following:—

1. The supply from the 1st of July, 1899, to the 30th of June, 1900, of 9000 Tons of GAS COALS, delivered at Porth and Ystrad Gas-Works.
2. CAST-IRON PIPES required from the 1st of July, 1899, to the 30th of June, 1900.

Specifications and Forms of Tender can be obtained on application to the Engineer and Manager, Mr. Octavius Thomas, Gas and Water Offices, Pentre, R.S.O.

Tenders, to be addressed to the Chairman of the Gas and Water Committee, endorsed "Tender for Coal," or "Tender for Pipes," and delivered at my Office on or before Ten a.m., Friday, the 26th of May, 1899.

The Council do not bind themselves to accept the lowest or any Tender.

WALTER H. MORGAN,
Clerk.

Council Offices, Pentre R.S.O., Glam.,
May 13, 1899.

COWES URBAN DISTRICT COUNCIL.

(GAS DEPARTMENT.)

TENDERS FOR FIRE GOODS.

TENDERS are invited for the following Goods:—

60 FURNACE ARCH BURS, 9 in. by 7 in. by 4½ in. by 8 in.
4 BURS, 24 in. by 5 in. by 5 in.
12 BURS, for 16-inch Retorts.

2½-inch FIRE-BRICKS	24,000
ARCH BRICKS, side	1,000
ARCH BRICKS, end, 2½ in. by 2½ in. by 9 in.	4,800
2-inch BRICKS	1,200
1½ inch, 1 inch, ½ inch FEATHEREDGE, SIDE BEVEL, END BEVEL, SOAP	250 each.
FIRE-CLAY, in Bags	20 Tons.

Tenders should specify Prices of each Article, and should include separate Prices for delivery to Tyne Docks, Newcastle, or as an alternative to the Gas-Works, Cowes, and state when the same can be delivered.

Sealed Tenders, to be endorsed "Tender for Fire Goods," to be delivered not later than mid-day on the 1st of June, 1899.

The Committee do not bind themselves to accept the lowest or any Tender.

WILLIAM HALLIDAY,
Secretary to the Special Gas Committee.

Offices: 40, High Street,
Cowes, Isle of Wight, May 9, 1899.

MANSFIELD CORPORATION.

(GAS DEPARTMENT.)

TENDERS FOR GAS COAL AND CANNEL.
TENDERS FOR TAR AND AMMONIACAL LIQUOR.

COAL.

THE Gas Committee are prepared to receive TENDERS for 2000 Tons of CANNEL and 7000 Tons of best screened GAS COAL, delivered at Mansfield Station, for One Year, from the 1st of June, 1899, to the 31st of May, 1900.

TAR AND LIQUOR.

Tenders for surplus TAR and LIQUOR made during the Year, from the 1st of July, 1899, to the 30th of June, 1900. Tenders for Liquor to be made either at a fixed price per Ton or on the Sliding-Scale regulated by the price of Sulphate.

Tenders, endorsed, to be sent to J. Harrop White, Esq., Deputy Town Clerk, Mansfield, on or before the 27th of May, 1899.

Particulars and all other Information from the undersigned.

No special Form of Tender provided.

The Committee do not bind themselves to accept the lowest or any Tender.

ARTHUR GRAHAM,
Engineer and Manager.

Gas-Works, Mansfield,
May 6, 1899.

TENDERS FOR GAS COAL.

THE Directors of the Gosport Gas and Coke Company invite TENDERS for the supply of 9000 Tons of good unscreened fresh wrought GAS COAL, to be delivered within the ensuing Twelve Months in such quantities as may be required, into Barges in Portsmouth Harbour, or in Barges alongside the Works, or at Gosport Railway Terminus.

Tenders, stating kind of Coal offered, to be addressed to the Chairman, and endorsed "Tender for Coal," to be delivered by the 17th of May, 1899.

The Directors do not bind themselves to accept any Tender.

G. B. IRONS,
Secretary and Superintendent.

Gosport, May 4, 1899.

CITY OF LEEDS.

(GAS DEPARTMENT.)

TENDERS required as below:—

For CRAVEN or DERBYSHIRE LIME.
For WROUGHT-IRON TUBES.
For PRESSED and COMMON RED BRICKS.

Forms of Tender may be obtained on application to the undersigned.

Endorsed Tenders, addressed to the Chairman of the Gas Committee, Municipal Buildings, Leeds, will be received not later than Tuesday, the 23rd inst.

The Committee do not bind themselves to accept the lowest or any Tender.

R. H. TOWNSLEY,
General Manager.

Municipal Buildings, Leeds,
May 13, 1899.

BOROUGH OF HAVERFORDWEST.

THE Corporation are prepared to receive TENDERS for the purchase of their surplus TAR now in Stock at their Gas-Works, amounting to about 140 Tons, more or less; to be delivered into Purchaser's Tank-Waggon at the Haverfordwest Railway Station, or into Steamer or Sailer at the Gas-Works Quay. Delivery to be completed within three months after acceptance of Tender.

Any further Information to be had upon application to the Manager of the Gas-Works, Haverfordwest.

Sealed Tenders, addressed to the undersigned, and endorsed "Tender for Tar," to be delivered at the Town Clerk's Office, not later than Thursday, the 18th of May next.

The highest or any Tender not necessarily accepted.

R. T. P. WILLIAMS,
Town Clerk.

Council Chambers, Haverfordwest,
May 5, 1899.

RHYL URBAN DISTRICT COUNCIL.

(GAS DEPARTMENT.)

THE Gas Committee of the Rhyl Urban District Council invite TENDERS for the supply of 4000 Tons of best screened GAS COAL for One Year, from the 1st of July, 1899, to be delivered f.o.r. Rhyl, in such monthly quantities as may be required.

Further Information and Forms of Tender may be obtained from Mr. Leonard G. Hall, Gas Engineer and Manager.

Sealed Tenders, endorsed "Tender for Coal," to be addressed to the Chairman of the Gas Committee, Clwyd Street Offices, Rhyl, on or before the 30th of May, 1899.

The Committee do not bind themselves to accept the lowest Tender.

ARTHUR ROWLANDS,
Clerk to the Council.

Council Office, Rhyl,
May 6, 1899.

STOKE-UPON-TRENT CORPORATION GAS-WORKS.

NEW RETORT-HOUSE, &c.

THE Gas Committee invite Tenders for the erection of a new RETORT-HOUSE, including Foundations, Arches, Brickwork, and Mountings for five through Beds of Retorts on the Regenerator Principle.

Plans and Specifications may be seen (or copies obtained on payment of 10s. 6d.), and other Particulars obtained from the undersigned, at the Gas-Works Offices, Wharf Street, Stoke-on-Trent.

Sealed Tenders must be addressed, F. Geen, Esq., J.P., Chairman of Gas Committee, and delivered not later than noon, May 18, endorsed "Tender for Retort-House."

The Committee do not bind themselves to accept the lowest or any Tender; but if a Tender is accepted, the time specified by the Tenderer for the completion of the work will be taken into consideration.

WM. PRINCE,
Engineer and Manager.

BOROUGH OF DARLINGTON.

TO COLLIERY PROPRIETORS.

THE Gas-Works Committee of the Darlington Corporation invite TENDERS for the supply of 30,000 Tons, or thereabouts, of SCREENED GAS COAL, delivered at their Gas-Works Railway Siding, during Twelve months commencing the 1st of July next, in such quantities as may be from time to time required by the Gas-Works Engineer.

The Coal proposed to be supplied must be of the best description for Gas Making, free from all Impurities, and to the satisfaction of the Gas-Works Engineer.

The Committee reserve the right of accepting a Tender for the whole or any portion of the quantity of Coal tendered for.

Tenders, endorsed "Tender for Gas Coal," and addressed to the Chairman of the Gas-Works Committee, Town Hall, Darlington, must be sent in not later than the 18th inst.

No pledge is given that the lowest or any Tender will be accepted.

HY. G. STEAVENSON,
Town Clerk.

Darlington,
May 5, 1899.

TENDERS FOR COAL AND CANNEL.

THE Gas Department of the Penrith Urban District Council are prepared to receive TENDERS for the supply of COAL and CANNEL during the Year ending June 30, 1900.

Tenders must be delivered to Mr. Geo. Wainwright, Public Offices, Penrith, not later than Wednesday, the 24th inst.

Forms of Tender and other Information may be obtained on application.

E. SHAUL,
Manager.

Gas-Works, Penrith,
May 12, 1899.

TO TAR DISTILLERS.

THE Gas Committee of the Penrith Urban District Council are open to receive TENDERS for the purchase of the surplus TAR produced at their Gas-Works during the Year ending June 30, 1900.

Particulars may be obtained from the undersigned, to whom Tenders must be delivered by Wednesday, the 24th inst., stating price per ton delivered into Contractors' Tank-Waggons on Rail at Penrith Station.

E. SHAUL,
Manager.

Gas-Works, Penrith,
May 12, 1899.

SOWERBY BRIDGE URBAN DISTRICT COUNCIL.

(GAS DEPARTMENT.)

THE Gas Committee of the above Council are prepared to receive TENDERS for the supply of 12,500 Tons of best GAS COAL and 1000 Tons of CANNEL required in each Year for One, Two, or Three Years from June 1, 1899.

Specifications and Forms of Tender can be obtained by applying to Mr. John Marsland, Engineer and Manager, Gas-Works, Sowerby Bridge.

The Council do not bind themselves to accept the lowest or any Tender.

Tenders must be sent in not later than Tuesday, May 23, 1899, endorsed "Tender for Coal" or "Cannel" respectively, and addressed to

GODFREY RHODES AND EVANS.
Commercial Bank Chambers, Halifax,
May 9, 1899.

BOROUGH OF BURTON-UPON-TRENT.

TO COLLIERY PROPRIETORS.

THE Mayor, Aldermen, and Burgesses of the Borough of Burton-upon-Trent, acting by the Council, are prepared to receive TENDERS from Colliery Proprietors for the supply of 25,000 Tons of best screened GAS COAL and 5000 Tons of CANNEL or portions thereof.

Forms of Tender and Conditions of Supply may be obtained upon application at my Office; and sealed Tenders, endorsed "Coal," are to be delivered to me at or before Ten a.m., on Thursday, the 25th day of May inst.

The Council do not bind themselves to accept the lowest or any Tender.

F. L. RAMSDEN,
Manager and Engineer.

Gas and Electric Light Works,
Wetmore Road, Burton-upon-Trent,
May 2, 1899.

COUNTY BOROUGH OF HUDDERSFIELD.

TENDERS FOR GAS COAL AND NUTS.

THE Gas Committee are prepared to receive TENDERS, from Colliery Proprietors only, for the supply and delivery of about 60,000 Tons of unscreened GAS COAL and screened NUTS for a period of Twelve Months, commencing the 1st of January, 1900.

Full Particulars and Form of Tender may be obtained on application to the Gas Engineer and Manager, Huddersfield.

Sealed Tenders, endorsed "Tender for Gas Coal," must be delivered, free of charge, addressed, in the handwriting of the Tenderer or his Agent, to the Town Clerk, Huddersfield, and delivered not later than Saturday, the 27th of May, 1899.

The Corporation do not bind themselves to accept the lowest or any Tender.

By order,
F. C. LLOYD,
Town Clerk.

Town Hall, Huddersfield,
May 11, 1899.

SHOTLEY BRIDGE AND CONSETT DISTRICT GAS COMPANY.

TO GASHOLDER MAKERS.

THE Directors of the above Company are prepared to receive TENDERS for the STEEL and IRON WORK required in the construction and erection of a Steel GASHOLDER TANK, 102 feet in diameter and 24 feet deep, and a SINGLE-LIFT GASHOLDER, with Guide-Framing, Inlet and Outlet Pipes, and Connections to same.

The Specification and Drawings may be seen on application at the Gas Offices, Shotley Bridge, and at the Offices of Messrs. Thomas Newbigging and Son, Engineers, 5, Norfolk Street, Manchester.

Copies of the Bill of Quantities and Forms of Tender may be obtained from the latter on payment of Two Guineas, which will be returned on receipt of a *bonâfide* Tender.

Sealed Tenders, endorsed "Gasholder Contract No. 2," and addressed to the Chairman, Gas Company, Shotley Bridge, to be sent so as to reach me not later than Twelve o'clock noon on June 14, 1899.

The Directors do not bind themselves to accept the lowest or any Tender.

M. RICHLEY,
Secretary.

Gas Office, Shotley Bridge,
May 11, 1899.

TENDERS are invited for 1000 Tons of GAS COAL to be delivered as required between the 1st of July, 1899, and the 30th of April, 1900, either at Felixstowe Beach Station, G.E.R., or in Cargoes of about 200 Tons alongside Felixstowe Dock.

Tenders, endorsed "Tender for Coal," to be delivered not later than the 25th of May, addressed to F. B. JENNINGS, Secretary, Gas Company, FELIXSTOWE.

THE East Dereham Urban District Council are prepared to receive TENDERS for the supply of about 1200 Tons of screened GAS COAL for the ensuing Year.

Conditions and Forms of Tender to be had of the undersigned.

Tenders to be sent in by the 24th of May, 1899, to

B. H. VORES,
Clerk to Urban District Council.

East Dereham.

ST. ANNE'S-ON-THE-SEA GAS COMPANY.

THE Directors are prepared to receive TENDERS for the supply of best screened GAS COAL required for the Year ending June 30, 1900.

Forms of Tender may be had on application.

Tenders, endorsed "Coal," and addressed to the Chairman, must be delivered at the Company's Offices not later than Thursday, May 18, 1899.

WILLIAM H. NUTTER,
Secretary and Manager.

Gas Offices, St. Anne's-on-the-Sea,
May 2, 1899.

TAR AND AMMONIACAL LIQUOR.

THE Directors of the Wrexham Gaslight Company invite TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR to be produced at their Works during the Year ending the 30th of June, 1900. Estimated total quantity of Tar 600 Tons, and Liquor 700 Tons.

Sealed and endorsed Tenders to be received on or before the 31st inst. by the undersigned.

WM. HEYWARD,
Secretary.

Gas Offices, Wrexham,
May 10, 1899.

CONTRACT FOR GAS COAL.

NOTICE is Hereby Given, that the Urban District Council of Horncastle in the County of Lincoln are prepared to receive TENDERS for the supply of from 500 to 2000 Tons (Railway Weight) of best screened SILKSTONE GAS COAL and GAS NUTS, to be delivered by the 30th of June, 1900, in such quantities and at such times as the Council may direct (500 Tons to be delivered by the 1st of August, 1899, if required). The Coal to be sent in a Dry Condition, free from Hards, Smudge, Dirt, Shale, Pyrites, or other Impurities.

Sealed Tenders, marked "Tender for Gas Coal," to be sent to the Clerk to the Council, on or before the 1st day of June, 1899.

The Council do not bind themselves to accept the lowest or any Tender.

By order,
S. GOE OVERTON,
Clerk to the Council.

2, Manor House Street, Horncastle,
May 13, 1899.

LURGAN GASLIGHT AND CHEMICAL COMPANY, LIMITED.

COAL WANTED.

THE Directors invite Tenders for the supply of Three Thousand Tons of best quality screened GAS COAL, delivered into Lighters, or placed on Rail, at Belfast.

Five Hundred Tons of the required quantity should be Scotch Coal, suitable for use in Hislop's Patent Regenerative Furnaces.

The Coal must be delivered in such quantities and at such times as the Directors may fix; but a large proportion can be taken before the 1st of November.

Each Cargo to be accompanied by a Certificate as to place of origin.

Tenders (in sealed envelope), accompanied by reference to Gas-Works using the Coal offered, should reach me not later than Seven o'clock in the Forenoon of Saturday, the 3rd of June, 1899.

The Directors do not bind themselves to accept the lowest or any Tender.

FRED. W. MAGAHAN,
Secretary.

Gas-Works, Lurgan,
May 1, 1899.

BOROUGH OF PETONE, NEW ZEALAND

TO GAS ENGINEERS, MANUFACTURERS, AND CONTRACTORS.

THE Petone Borough Council invite TENDERS for the supply and delivery at the Port of Wellington, New Zealand, of the undermentioned Plant and Apparatus for the Manufacture and Distribution of Coal Gas—viz., RETORT-HOUSE IRONWORK and FIRE-CLAY GOODS, EXHAUSTER, CONDENSER, SCRUBBER, TWO PURIFIERS, STATION METER, 40 feet GASHOLDER, STATION GOVERNOR, 6-inch, 4-inch, and 3-inch Cast-Iron Spigot and Faucet MAIN PIPES, Wrought-Iron TUBES and FITTINGS, LAMP-POSTS, TOOLS, and SUNDRIES.

Plans, Specifications, and Tender Forms may be inspected at the Office of the "JOURNAL," 11, Bolt Court, Fleet Street, London, E.C.

Tenders, sealed and endorsed "Tender for Gas Plant," will be received at the Office of the Borough Council, Petone, Wellington, New Zealand, until Friday, the 30th day of June, 1899.

The Council do not bind themselves to accept the lowest or any Tender, and may accept the whole or any part of a Tender as they may see fit.

R. CLEMENT KIRK,
Mayor.

Petone, March 15, 1899.

THE Directors of the Petworth Coal Gas and Coke Company invite TENDERS for the supply of 600 Tons of good GAS COAL, to be delivered free at Petworth Station, L.B. & S.C. Railway, when required between June 30, 1899, and June 30, 1900.

Sealed Tenders, endorsed "Coal," to be sent to the Secretary, on or before Friday, June 2, 1899.

The Directors do not bind themselves to accept the lowest or any Tender.

No Tender Forms supplied.

C. H. DOWNS,
Secretary.

Petworth, May 17, 1899.

NEWCASTLE-UPON-TYNE AND GATESHEAD GAS COMPANY.

SALE BY TENDER OF £35,000 THREE-AND-A-HALF PER CENT. PERPETUAL DEBENTURE STOCK.

MINIMUM PRICE, £107 10s. PER CENT.

NOTICE is Hereby Given, that it is the intention of the Directors of this Company to SELL BY TENDER £35,000 of THREE-AND-A-HALF PER CENT. PERPETUAL DEBENTURE STOCK, to be issued under the Provisions of the Newcastle-upon-Tyne and Gateshead Gas Act, 1896.

Particulars and Forms of Tender may be obtained on application to the undersigned; and Tenders must be sent in so as to be received at the Office of the Company not later than Ten a.m. on Tuesday, the 30th of May, 1899.

The Stock will be allotted to the highest bidders; but no tender will be accepted at a lower price than at the rate of £107 10s. money for each £100 Debenture Stock.

By order,
THOMAS WADDOM,
Secretary.

Chief Offices: 35, Grainger Street West,
Newcastle-upon-Tyne, May 8, 1899.

IMPORTANT SALE OF GAS SHARES.

MR. W. H. SWANNELL has received Instructions from the Directors of the Rickmansworth Gaslight and Coke Company, Limited, to SELL BY AUCTION, at the Town Hall, Rickmansworth, on Wednesday, June 7, 1899, at Five o'clock precisely, 700 NEW £5 SHARES; being the issue of Additional Capital of the said Company, ranking for a prescribed rate of Dividend not exceeding 7 per cent., subject to the Sliding-Scale mentioned in the Rickmansworth Gas Order, 1885.

Particulars and Conditions of Sale may be had of HARVEY W. FELLOWS, Esq., Solicitor, RICKMANSWORTH; and of the AUCTIONEER, High Street, RICKMANSWORTH.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held MONTHLY, at the Mart, Tokenhouse Yard, E.C.

He also undertakes the issuing by Auction of Gas and Water Stocks and Shares under Parliamentary Powers.

Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. Alfred Richards's Offices, 18, FINSBURY CIRCUS, E.C.

By order of the Directors.

CATERHAM AND DISTRICT GASLIGHT AND COKE COMPANY, LIMITED.

250 £10 FIVE PER CENT. PREFERENCE SHARES.
(TO BE ISSUED AS FULLY PAID.)

MR. ALFRED RICHARDS will Sell THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, May 30, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Executors of the late Mrs. Catherine Brown, jointly with Mr. Henry Brown.

RAYLEIGH.

FREEHOLD GAS-WORKS.

MR. ALFRED RICHARDS will Sell BY AUCTION, at the Mart, Tokenhouse Yard, E.C., on Tuesday, May 30, at Two o'clock,

THE FREEHOLD GAS-WORKS OF THE RAYLEIGH GAS COMPANY, AT RAYLEIGH, ESSEX.

Advantageously placed in a central position, within about 350 yards of Rayleigh Station and Goods Yard on the G.E.R., affording excellent facilities for economical carriage of Coal, &c. The Works comprise: RETORT-HOUSES, GASHOLDER, COAL-STORE, CONDENSER, WASHER-SCRUBBER, Three PURIFIERS, STATION METER, GOVERNOR, &c., MANAGER'S HOUSE, OFFICE, and WORKSHOP, together with the DISTRIBUTING PLANT. The whole to be sold as a GOING CONCERN and with POSSESSION on COMPLETION.

May be viewed, and Particulars with Conditions of Sale obtained, of LOXLEY, ELAM, AND GARDNER, Solicitors, 80, CHEAPSIDE, E.C.; of Mr. ROBERT JAMES TWYFORD, Solicitor, 44, FINSBURY PAVEMENT, E.C.; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

Price 6s., Cloth Bound,

THE CHEMISTRY OF ILLUMINATING GAS.

By N. H. HUMPHRYS, Assoc.M.Inst.C.E., F.C.S.

LONDON: Walter King, 11, Bolt Court, Fleet St., E.C.

THE ACETYLENE ILLUMINATING CO., LTD.,
MANUFACTURERS OF CARBIDE OF CALCIUM,
63, QUEEN VICTORIA STREET, LONDON, E.C.,
and FOYERS, SCOTLAND.

(The Acetylene Illuminating Company, Limited, Incorporated in May, 1895, as a Private Development Company, was the First Undertaking established in Europe for the Manufacture of Carbide of Calcium.)

NOTICE.

THE Acetylene Illuminating Company, Limited, possesses an exclusive Licence for the United Kingdom to use for the manufacture of Carbide of Calcium for Light, Heat, and Power Purposes, the Inventions which are comprised in Mr. Willson's British Letters Patent. The Company is also similarly licensed under the British Letters Patent owned by the British Aluminium Company, Limited, so far as these relate to the manufacture of Carbide of Calcium for the same purposes.

The Patents have been submitted to Mr. Fletcher Moulton, Q.C., Mr. Roger Wallace, Q.C., and Mr. Arthur Colefax, who have given the following joint opinion:—

"In our opinion The Acetylene Illuminating Company, Limited, by their Patents control the process "by which alone Calcium Carbide can be commercially produced by electricity, and are also "entitled thereunder to prevent the importation into "this country of Calcium Carbide so produced."

The Acetylene Illuminating Company, Limited, are determined to permit of no Infringement of their Patent Rights, and have brought an Action against the Midland Acetylene (Parent) Syndicate, Limited, to restrain them from manufacturing Carbide of Calcium by means of the Electric Furnace. The Acetylene Illuminating Company intend in future to bring actions against all Infringers of their Patents, whether Manufacturers or Importers, and against all Purchasers of Carbide of Calcium made or imported in Infringement of their Patent Rights.

NOTICE.

THE Acetylene Illuminating Company, Limited, having published and issued an advertisement or circular claiming that they hold the British Patents for the Manufacture of Calcium Carbide by means of the Electric Furnace, we guarantee to indemnify anyone who buys Carbide from us against any claim by "The Acetylene Illuminating Company, Limited," or anyone else.

THE READ-HOLLIDAY ACETYLENE COMPANY, LIMITED, Acetylene Gas Engineers and Carbide of Calcium Manufacturers, HUDDERSFIELD.

NOTICE.

THE Acetylene Illuminating Company, Limited, having published and issued an advertisement or circular claiming that they hold the British Patents for the Manufacture of Calcium Carbide by means of the Electric Furnace, we guarantee to indemnify anyone who buys Carbide from us against any claim by "The Acetylene Illuminating Company, Limited," or anyone else.

TINKER AND HOLLIDAY, LIMITED, Carbide of Calcium Manufacturers, HAZELHEAD, SHEFFIELD.

NITRATE OF THORIUM AND CERIUM.

FABRIK CHEMISCHER PRAEPARATE VON STHAMER, NOACK, AND CO., HAMBURG.

THOMAS DUXBURY & CO.,
16, DEANSGATE, MANCHESTER.
GAS ENGINEERS' AGENTS AND CONTRACTORS FOR
Meters, Fire-Clay Goods, Oxide of Iron, and all other Gas Apparatus. Retort Carbon purchased.
Inquiries Solicited.
Telegrams: "DARWINIAN, MANCHESTER."
Telephone 1806.

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ALL KINDS
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OF THE
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FOR
GAS ENGINEERS
AND MANAGERS.
BY
THOMAS NEWBIGGING,
M.Inst.C.E.

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WALTER KING, 11, BOLT COURT,
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ENRICH YOUR GAS
WITH
CHEAP BENZOL.
AT to-day's Price of Benzol, Illuminating POWER costs less than ONE-THIRD OF A PENNY PER CANDLE.
Apply to SADLER & CO., MIDDLESBROUGH.

DISPENSE WITH CANNEL COAL
and
INCREASE YOUR ILLUMINATING POWER
by using the
WHESSOE-MUNICH BENZOL CARBURETTER
The Cheapest and Best in the Market.
The Managers of Tynemouth, Middlesbrough, and Darlington Gas-Works are much pleased with it, and would not be without it.
Apply to the Sole Makers
THE WHESSOE FOUNDRY COMPANY, LIMITED,
DARLINGTON.

HEBBURN MAIN GAS COALS.

Yield of Gas per Ton . .	10,500 Cubic Feet.
Illuminating Power . . .	16·4 Candles.
Coke	68 per Cent.

For Prices, f.o.b. Ship or Delivered by Rail, apply to
The Wallsend & Hebburn Coal Company, Ltd.
8 Lombard Street,
NEWCASTLE-ON-TYNE.
W. RICHARDSON, Fitter.

BOLDON GAS COALS.

ANALYSIS.

Yield of Gas per Ton. .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

For Prices, &c., apply to
W. H. PARKINSON,
THE HARTON COAL CO., LTD.,
NEWCASTLE-ON-TYNE.
Telegraphic Address: "PARKINSON, NEWCASTLE."

PRICE'S COKE & COAL BARROW

effects a great saving of time, labour, and expense.
For Particulars, Price, &c., apply to Mr. EDWARD PRICE, 119, Queen's Road, FINSBURY PARK, N.
Prices are Reduced.

COKE-BREAKERS,
PRICES REDUCED.
(THOMAS & SOMERVILLE'S PATENT)
With Elevators and Conveyors worked by Steam or Gas Engine.
GEORGE WALLER & CO.,
165, QUEEN VICTORIA STREET, E.C.;
And at STROUD, GLOUCESTERSHIRE.

UNEQUALLED.
Gas Companies are solicited to try Samples of the
MIRFIELD
BLACK BED GAS COAL.
Prices and Analysis on application.
MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

THE SILICA FIRE-BRICK
COMPANY,
OUGHTIBRIDGE, near SHEFFIELD,
MANUFACTURE]
SILICA BLOCKS,
BRICKS, AND CEMENT
OF SUPERIOR QUALITY
FOR GAS-FURNACES.
Trade Mark: "SILICA."
These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their
GREATER DURABILITY,
Strongly recommended where EXCESSIVE HEATS have to be maintained.

INCANDESCENT
GAS LIGHTING
Has now gained a complete and final Victory over its last and greatest Enemy
VIBRATION,
BY MEANS OF
CLAY'S PATENT
SHOCK-PROOF
Incandescent Burner Fittings
Of which full Particulars may be had from
CLAY & WALMSLEY,
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Telegrams: "CLAYS, BOLTON.
See "JOURNAL OF GAS LIGHTING," Dec. 13, 1898, p. 1358, and Jan. 17, 1899, p. 130.
London Representatives: H. Greene & Sons, Ltd. 19, Farringdon Road.

TROTTER, HAINES, & CORBETT,
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FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Proprietors of
BEST GLASSHOUSE POT & CRUCIBLE CLAY.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

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JAMES OAKES & CO.
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,
Manufacture and keep in Stock at their Works (also large stock in London)
PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts and Covers, and rendering Leakage impossible.

LONDONDERRY GAS COALS
FROM THE
MARQUIS OF LONDONDERRY'S COLLIERIES,
COUNTY OF DURHAM.
Available Output up to 5000 Tons per day.
Yield of Gas 11,000 cubic feet per Ton of Coal as per Analysis by
Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO
S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

HOLMSIDE
GAS COALS.
Present Daily Produce over 5000 Tons.
Latest Analysis—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation

Yield of Gas per Ton	11,205 Cubic Feet.
Illuminating Power	16 7/10 Stand. Sperm. Candl.
Coke (of good & pure quality)	13¾ Cwt. per Ton.
Sulphur	A little over 1 per Cent.
Ash	Under 1 per Cent.
Tar	163 lbs. (Avoir.) per Ton.
Ammoniacal Liquor	103 lbs. (Avoir.) per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR
PELTON GAS COALS.
Present Daily Produce available 3000 Tons.
Of equal quality to the "Holmside" Coal, and also very largely used by many Gas Companies at Home and Abroad.
Both descriptions are shipped at Tyne Docks, and Dunston Staiths, River Tyne, also at North and South Docks, Sunderland.
These Coals may be bought through the Principal Merchants in England, or direct from
MR. MARK ARCHER,
HOLMSIDE & SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

EVESON FOR CANNEL
TELEGRAMS: "EVESON, BIRMINGHAM."

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Highest Results in Gas, & Excellent Coke.
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LIMITED,
NEWBATTLE COLLIERIES,
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THORNLEY GAS COALS
WORKED BY THE
WEARDALE IRON & COAL Co., Ld.
OUT OF THEIR
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Analysis made by
Messrs. J. & H. S. PATTINSON, *May 28, 1895.*

Yield of Gas per Ton	10,500 Cub. Ft.
Illuminating Power	16·9 Candles.
Coke (of good quality)	67·5 per Cent.
Sulphur	0·58 ,,
Ash	2·73 ,,

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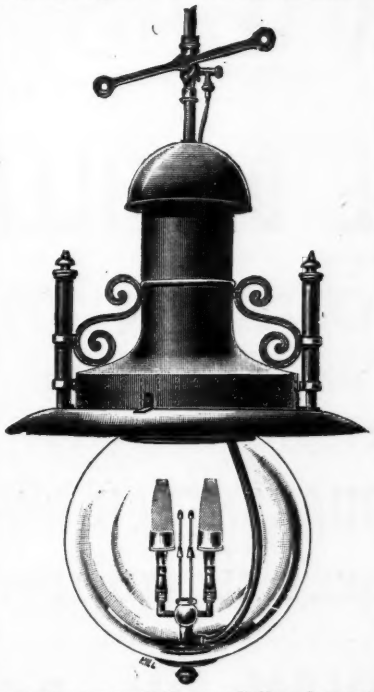

As fitted at London Bridge near Railway Approach; three Lamps giving the Illuminating Power of 600 Candles. See Surveyor's Report as published in the "*JOURNAL*" for Jan. 10, 1899.

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Illuminating Power	38·22 candles
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	17·8 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

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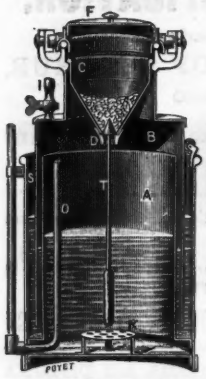

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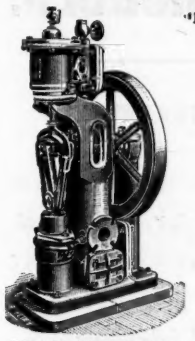

"Fig. 705. SINGLE RAM" STEAM-PUMP.

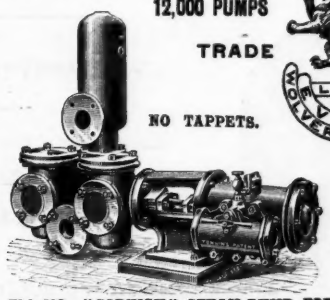

Fig. 596. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

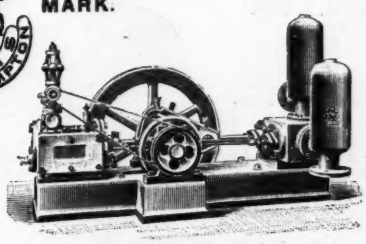

Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

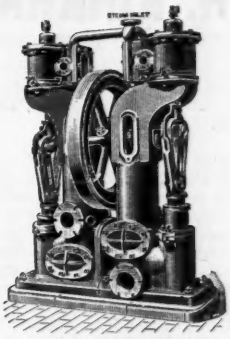

Fig. 712 "DOUBLE-RAM" STEAM-PUMP.

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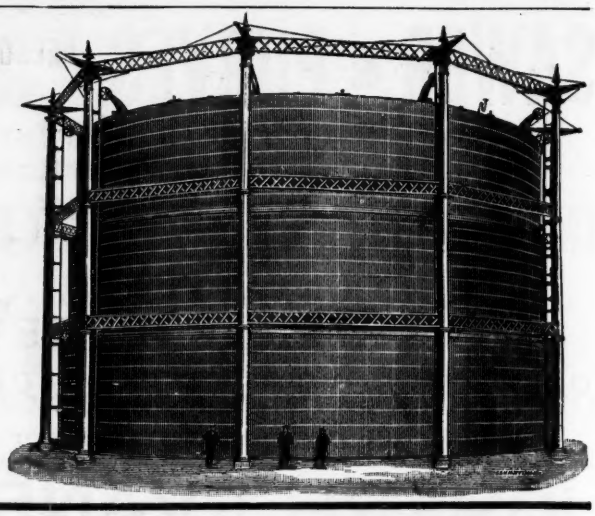


H. KIRKHAM'S PATENT "IMPERIAL" WASHER-SCRUBBER.

TESTIMONIAL

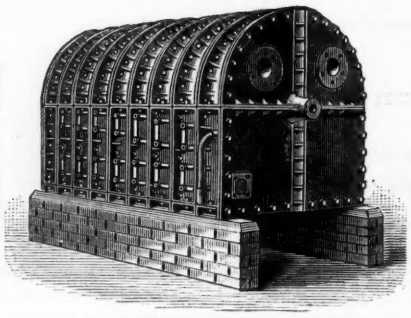
The Dover Gaslight Company,
Gas-Works, Buckland,
Dover, Feb. 8, 1899.

H. KIRKHAM, Esq.

Dear Sir,—Have now made further tests with the Washer fitted with your PATENT WASHING DEVICES, and have much pleasure in reporting that *the results were highly satisfactory*; also, I ascertained that the maximum results were obtained when the machine was working at three revolutions per minute. At this speed 13 to 14 gallons of water per ton of coal carbonized were converted into 10-oz. Ammoniacal Liquor, and at same time the Gas was free from Ammonia.

Should you wish further details, I will forward them.

I am, dear Sir, yours truly,
RAPHAEL HERRING, Engineer.



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Estimates given for a complete set of Segments for one wheel, or for refitting the whole number of wheels in a machine, also for Washer-Scrubbers complete.

The Scrubbing Devices are metal scrolls fixed in cages of segmental form, which can be readily and successively removed from the wheels through a manhole on the top or side of the machine, and the enclosed Scrubbing Devices taken out, cleaned, and replaced without the delay that necessarily takes place when the entire scrubbing material of the whole wheel has to be dealt with in one operation—thus effecting an important saving in time and labour. These Cages can be applied to the wheels of any machines of the type shown, and will increase their efficiency above 20 per cent.

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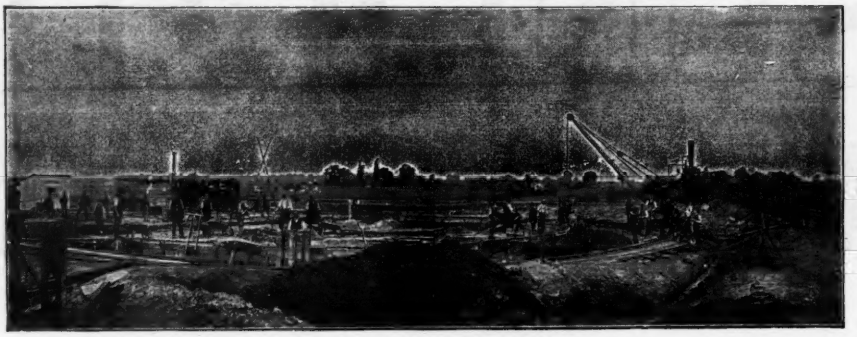

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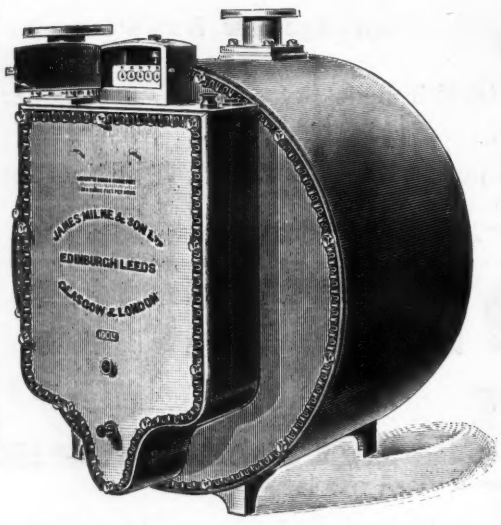

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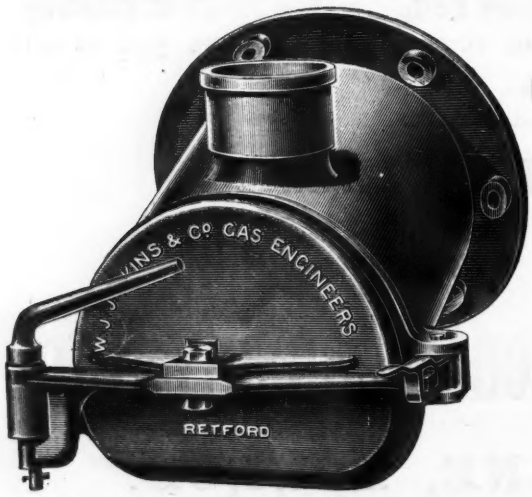

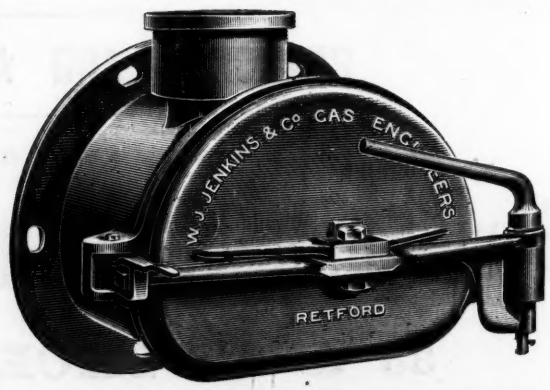

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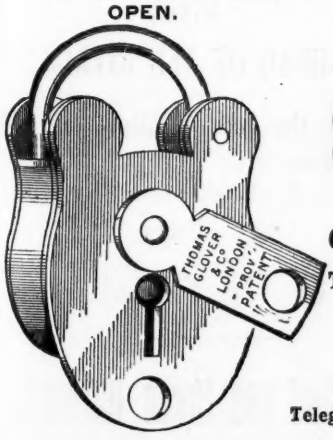

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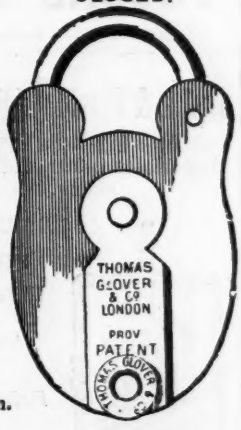

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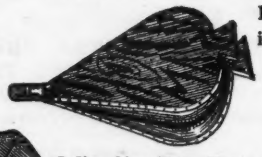

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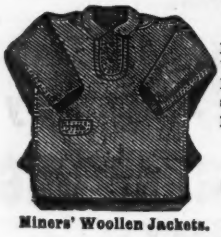

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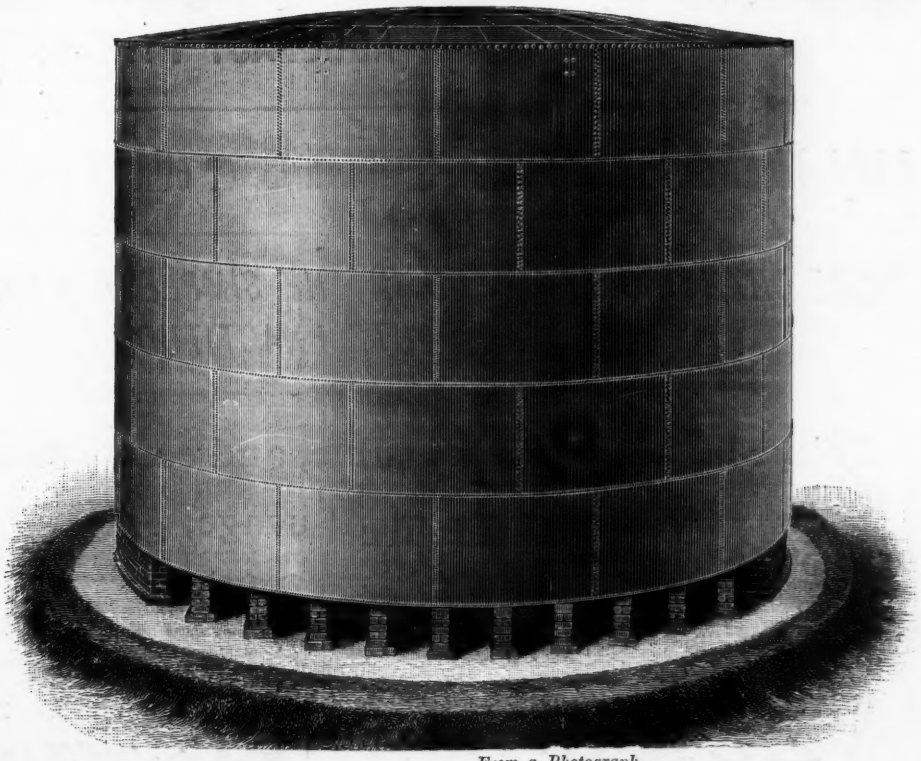

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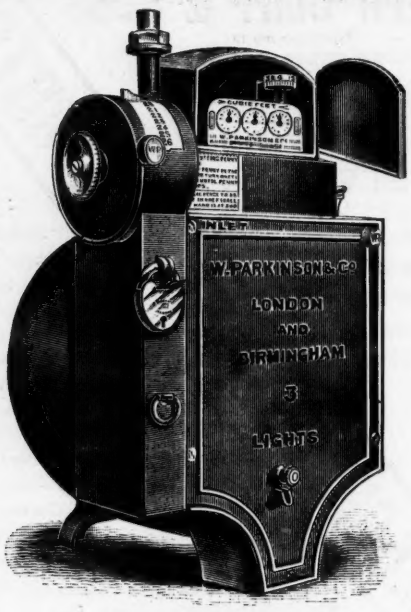

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[See also Advt. p 1266.

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